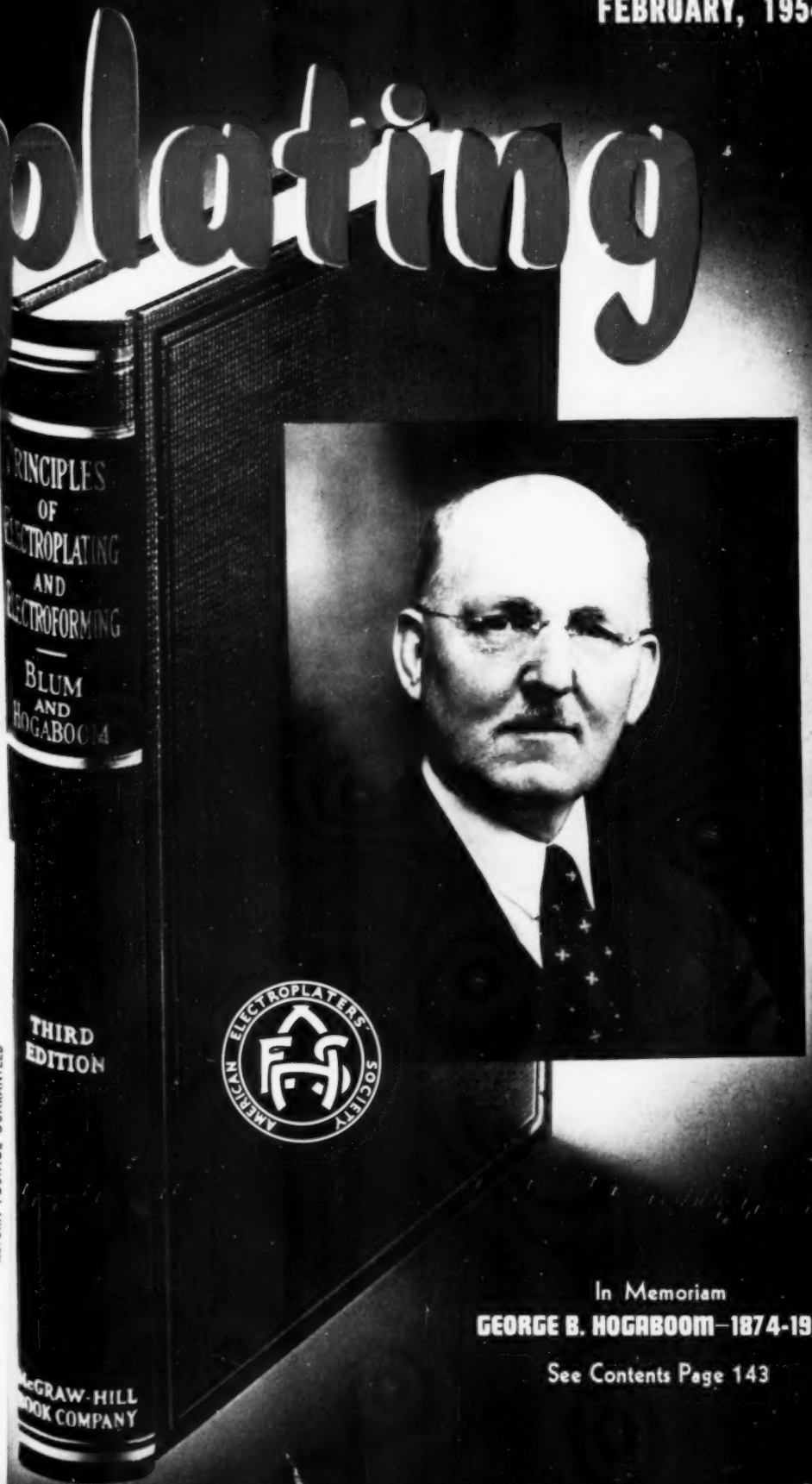
VOLUME 41
NUMBER 2

FEBRUARY, 1954

plating



In Memoriam

GEORGE B. HOGABOOM—1874-1953

See Contents Page 143

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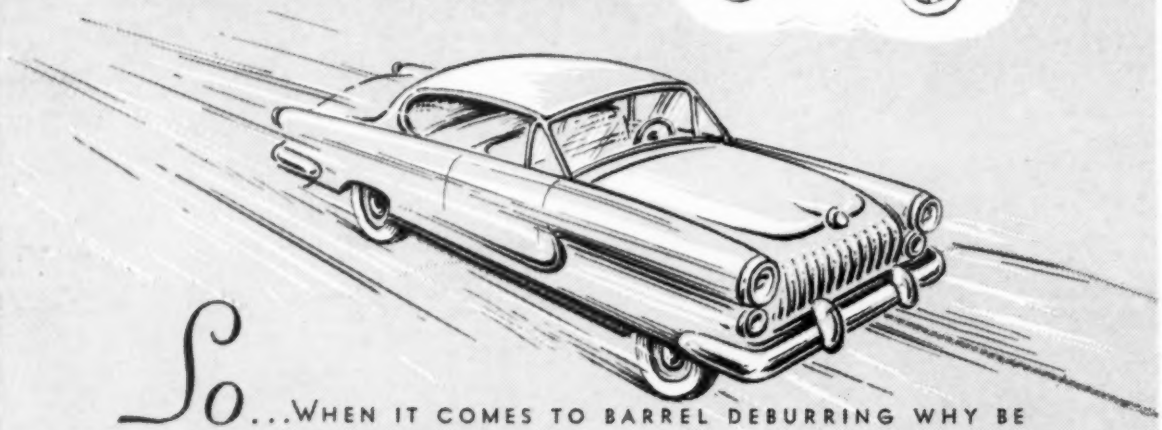

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THE NEWEST DEBURRING MEDIUM

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LOWER OPERATING COST
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SUPPLIED ONLY THROUGH SERVICE ENGINEERS OR DISTRIBUTORS OF

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An alkaline stripper that dissolves nickel, copper, zinc, cadmium and silver without attack on steel or stainless steel.

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ZINC STRIPPER
An alkaline stripper for fast stripping of zinc from steel and copper.

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AMBLER ACP PENNA.

Technical Service Data Sheet
Subject: INDEX OF ACP CHEMICALS FOR METAL PRESERVATION AND PAINT PROTECTION

METAL	OPERATION	ACP CHEMICAL
ALUMINUM	*Cleaning*	"DEOXIDINE" "DURIDINE" "ACP RIDOLINES AND RIDOSOLS"
	Preparation for Painting	"ALODINE" "DURIDINE" "DEOXIDINE"
	Protection from Corrosion	"ALODINE"
BRASS	*Brightening*	"ACP BRIGHT DIP"
	Cleaning	"DEOXIDINE" "DURIDINE" "ACP RIDOLINES AND RIDOSOLS"
	Cleaning for Painting	"DEOXIDINE" "CUPROTEK
	Corrosion Prevention	"CUPROTEK"
	Soldering Flux	"FLOSOL"
COPPER, BERYLLIUM, AND COPPER ALLOYS	*Brightening*	"ACP BRIGHT DIP"
	Cleaning	"DEOXIDINE" "DURIDINE" "ACP RIDOLINES AND RIDOSOLS"
	Cleaning for Painting	"DEOXIDINE" "CUPROTEK"
	Coating Steel with Copper	"CUPRODINE"
	Corrosion Prevention	"CUPROTEK"
	Scale Modification	"RIDOXINE"
	Soldering Flux	"FLOSOL"
	Stripping Copper Coatings	"ACP COPPER STRIPPING SOLUTION"
GALVANIZED IRON, ZINC, AND CADMIUM	*Cleaning*	"DURIDINE" "ACP RIDOLINES AND RIDOSOLS"
	Corrosion Proofing	"ZINODINE"
	Paint Bonding	"ZINODINE"
	Phosphate Coating, in Preparation for Painting	"LITHOFORM"
	Soldering Flux	"FLOSOL"
IRON AND STEEL	*Chromate Coating, in Preparation for Painting*	"CROMODINE"
	Cleaning	"ACP RIDOLINES AND RIDOSOLS"
	Cleaning for Painting	"DEOXIDINE" "DURIDINE"
	Coating with Copper	"CUPRODINE"
	Drawing and Extrusion	"GRANODRAW"
	Paint Bonding	"CROMODINE" "DURIDINE" "GRANODINE" "PERMADINE" "THERMOIL-GRANODINE"
	Paint Stripping	"CAUSTIC SODA AND SOLVENT NO. 3"
	Phosphate Coating, in Preparation for Painting	"DURIDINE" "GRANODINE" "PERMADINE" "THERMOIL-GRANODINE"
	Phosphate Coating, to Protect Friction Surfaces	"THERMOIL-GRANODINE"
	Pickling with Inhibited Acids	"RODINE"
	Rust Prevention for Unpainted Iron	"PEROLINE"
	Rust Proofing	"PERMADINE" "THERMOIL-GRANODINE"
	Rust Removal—Brush, Dip, or Spray	"DEOXIDINE"
	Soldering Flux	"FLOSOL"
MAGNESIUM	*Cleaning*	"DURIDINE" "ACP RIDOLINES AND RIDOSOLS"
	Pickling	"RODINE (M-200)"
STAINLESS STEEL	*Cleaning*	"DEOXIDINE"
	Coating with Copper	"CUPRODINE"
	Pickle Polishing	"RODINE"
	Soldering Flux	"FLOSOL"

CHEMICALS ACP PROCESSES

WRITE FOR DESCRIPTIVE FOLDERS ON THE ABOVE CHEMICALS AND FOR INFORMATION ON YOUR OWN METAL PROTECTION PROBLEMS

CHEMICALS ACP PROCESSES

In This Issue

Radiometric Study of Supplementary Chromate Coatings for Zinc and Cadmium Plating by Stanley L. Eisler, Jodie Doss and Mary Ann Henderson. The authors report on their use of radiosulfur and radiochromium in the determination of the amounts of sulfate and chromium contained in chromate coatings produced on zinc and cadmium plated test panels. The leaching of the same two ions during exposure also was determined. They found that the amount of sulfate and chromium in the coating increased as the concentration of H_2SO_4 in the film-forming solution was increased. The loss of chromate was found to be at a much slower rate and at a much lower total value than was the loss of sulfate.

The Colorimetric Determination of Zinc in Effluents by R. F. Muraca, D. G. Gardner and E. J. Serfass. The authors report that their method, using dithizone as the color forming reagent, gives satisfactory results in the presence of 100 to 5000 ppm of each of 25 ions in simultaneous admixture. Cupferron extraction and complexing with cyanide and thiosulfate are employed to eliminate interfering elements. A shortened procedure is provided for use when the amounts of materials other than zinc are known or can be estimated. A previous paper (PLATING, February, 1953) by the same authors described a method for the determination of cadmium.

Bicycle Horns Coated by Vacuum Metalizing. Is a picture story in which are described the production and finishing techniques that have been worked out by one company. The photos illustrate the various processing steps employed.

The Nature, Cause and Effect of Porosity in Electrodeposits. I. The Porosity of Electrodeposits by Fielding Ogburn and Asaf Benderly. AES Research Project No. 13. The concluding part of the report, the initial installment of which appeared in the January issue.

George B. Hogaboom—A Tribute. Two brief resumes outline the high lights in the life of Founder and Honorary Member, and first AES President, G. B. Hogaboom.

For page numbers, see Table of Contents, page 143

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IN CADMIUM BRIGHTENERS IT IS

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CHECK THESE POINTS:

1. Proved in over 5 years of use.

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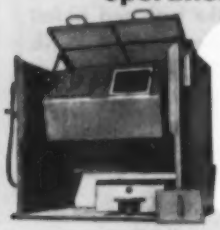

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Industry News

Davies Opens Kansas City Branch. L. A. Davies, president of the Davies Supply and Manufacturing Co., has announced the opening of a Kansas City branch. The new office at 814-816 W. 17th St., will be headed by Dick Loupee. Replacing him as sales representative in the St. Louis and Southern Illinois territory will be Arthur P. Wrisberg. After attending Washington University and City College of Law and Finance, Wrisberg was with Lasalco Inc. of St. Louis. His 14 years there included service in the Navy during World War II.

R. J. Colvin wins Ball Award for Oakite Service. John A. Carter, president of Oakite Products, Inc., presents the 1953 D. C. Ball Award to R. J. Colvin, Syracuse, N. Y., representative of the firm. The award, presented annually in memory of the firm's founder to the Oakite representative who has rendered exceptional service to industry, was made at the regional technical-sales conference held at New York's Roosevelt Hotel

Sustaining Members

Five more organizations have joined the AES Research Sustaining Membership program. The new members listed in the latest report to Headquarters by the Chicago, New York (3) and St. Joseph Valley branches are:

Electro Glo Company
Chicago, Ill.
Levco Metal Finishers, Inc.
Long Island City, N. Y.
Regent Metal Products, Inc.
Brooklyn 11, N. Y.
Roth Plating Corporation
South Bend, Ind.
Star Chromium Corporation
Long Island City, N. Y.

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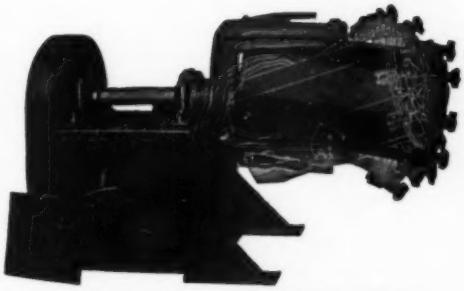
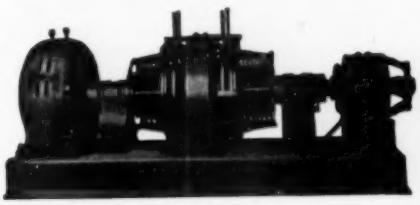
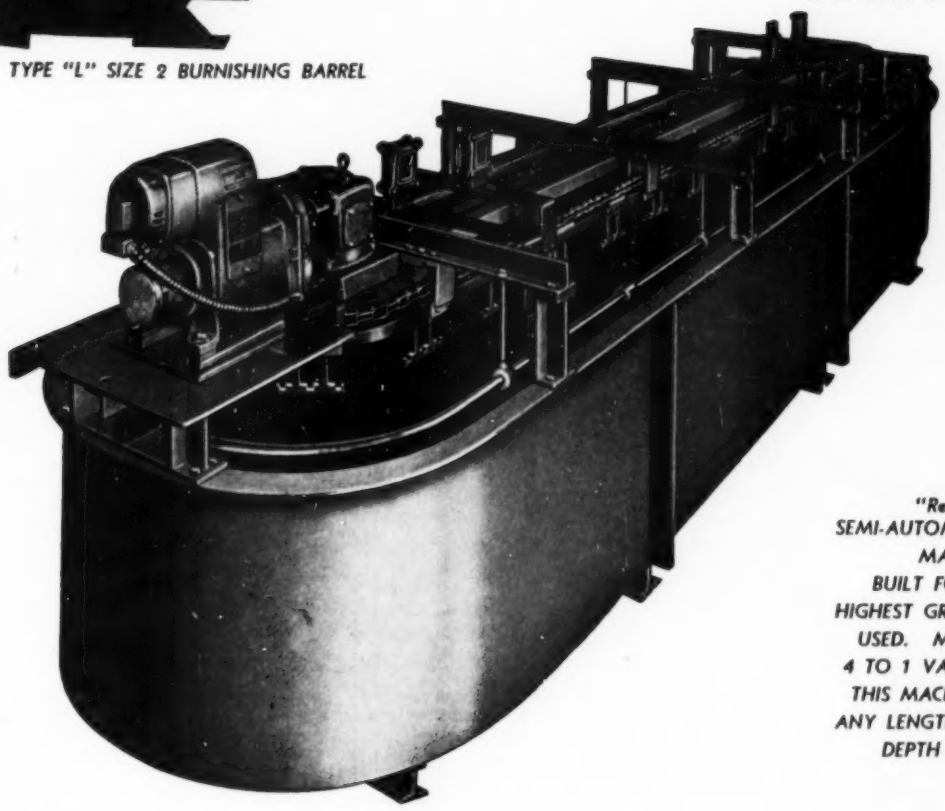


TYPE "L" SIZE 2 BURNISHING BARREL



3000 AMP. 6 VOLT GENERATOR SET



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Industry News

Borolite Corporation Expansion. Three well-known companies have united forces to expand the activities of the Borolite Corporation, which was recently formed to pursue research and development of various metal borides ("borolites") for high temperature military and civilian applications, according to a joint announcement by the presidents of the three cooperating companies—Mr. Kenneth D. Mann, of Firth Sterling Inc., Pittsburgh, Pa.; Dr. Paul Schwarzkopf, of American Electro Metal Corporation, Yonkers, N. Y.; and Major General Clinton F. Robinson, of the Carborundum Company, Niagara Falls, N. Y.

Borides, carbides, and aluminides, all part of the Borolite Corporation's program, show promise of withstanding operating temperatures ranging from 1600° to 2000° F, for turbo-jets and up to 7000° F for rocket nozzles and intermediate applications.

Metal Finishing Suppliers' Association Meeting. The trustees of the Metal Finishing Suppliers' Association, Inc., held a special board meeting on the afternoon of December 19 in the Robert Treat Hotel in Newark, N. J.

While the chief purpose of the meeting was a year-end appraisal of the activities of the corporation during 1953, much time was devoted to plans for 1954, with particular consideration being given to the part that the MFSA will play in the coming AES Convention in New York City this summer. A number of committees of the two organizations already are collaborating in an effort to make this affair a memorable and most successful one.

Although it may seem premature to some, the meeting also heard a report on the hotel situation in Cleveland where the 1955 Annual Convention is scheduled to be held. Mr. T. A. Trumbour of the Open House Committee was authorized to take such steps as appeared desirable to make proper arrangements to accommodate the functions of the MFSA there at that time.

The Treasurer reported the Corporation to be financially in the soundest position in its 30-year history; and before the meeting adjourned, the trustees listened to a proposal from Mr. R. M. Shock of NAMF Inc., advocating closer cooperation between all the organizations in the Industry toward their common advantage.

Udylite Opens Warehouses. L. J. George, Chicago district manager of the Udylite Corporation, announced the opening of a new warehouse in Rockford, Ill., to be under the direct supervision of David B. Stockton, resident sales engineer.

The warehouse at 310 Market St. is amply stocked with metal plating and finishing supplies. Firms in the area were formerly serviced from the Chicago factory.

Another new warehouse dedicated to "speed in filling local orders" has been opened at 5203 Martin Ave., Detroit, Mich.

Other Udylite warehouses are in Atlanta, Cleveland, Chicago, Grand Rapids, Indianapolis, New York and Philadelphia.

Diversey (Canada) Acquires Distributor. The Diversey Corporation has announced that its Canadian affiliate, The

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BUFFING COMPOUND
CHEMIST

Chemist wanted with at least 5 years experience in manufacturing buffing and polishing compounds. Must know abrasives, greases and kindred raw materials. Exceptional Opportunity in Profit Sharing Plan. We are well established in our industry. *Write:*

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POSITION WANTED

Plater with 17 years experience in all types of plating operations available. Can take full charge of shop, supervision, racking, maintenance of solutions, etc. Metropolitan New York area. *Reply to:*

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ANODIC CLEANING,
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The right electrolytic cleaning compound for whatever purpose you may need is assured when you use a PERMAG cleaning compound.
While extremely adaptable to the various finishing processes, PERMAG compounds are designed to do a particular job.
White metals, whether for electrodeposition or other finishing, always come clean under PERMAG treatment. Our technical service staff will be glad to make recommendations on any cleaning problem you may have.
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CANADIAN PERMAG PRODUCTS, LTD., MONTREAL

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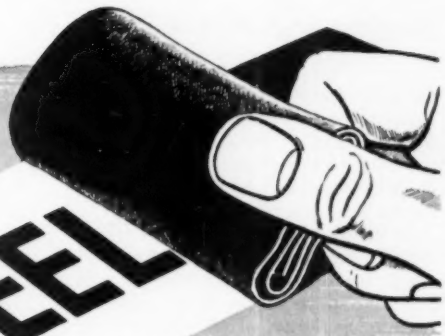

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STOP-OFF LACQUER

- **Can be peeled off after plating**
- **Will hold hairline demarcation**
- **For use in all plating cycles**
- **Easy to apply**
- **Safe to use**

MICCROPEEL is the new companion product to the already famous Stop-Off materials: MICCROSTOP, MICCROMASK, and MICCROWAX.

Like the others, MICCROPEEL will hold a sharp, accurate line of demarcation in all plating cycles. It will also go through cleaners and hot solutions without loosing its superior adhesion on sharp edges.

MICCROPEEL can be peeled off after plating. Parts can be peeled quickly and passed on to the next operation with minimum time and effort expended.

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Developed and manufactured by experienced platers

Industry News

Diversey Corporation (Canada) Ltd., has purchased controlling interest in Sanitary Products, Ltd. of St. Johns, Newfoundland. The firm is Newfoundland's largest distributor of industrial and maintenance materials.

H. W. Kochs, Chairman of The Diversey Corporation, said the purchase will enable the Canadian affiliate to provide better service to its customers and to extend its operations. New warehouse facilities are being erected immediately and manufacturing facilities are contemplated.

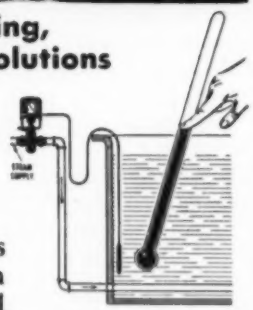
Photo shows record shipment of rectifiers in front of Rapid plant

Record Delivery. Rapid Electric Company was especially true to its name by recently making delivery of 24,000 amperes/12 volts rectifying power capacity in just 9½ working days. An emergency order for six rectifiers, each 4000 amperes/12 volts, with three remote control cubicles, each handling 8000 amperes/12 volts was phoned into Rapid's main office. Final testing and inspection of the ordered units was completed only 9½ days later whereas normal delivery on a shipment of this size is usually quoted as being 6–8 weeks.

New Magnet Material. A completely new type of magnet, composed of ceramic material which is lighter in weight than metal and requires no critical ingredients, has been announced by the Indiana Steel Products Company of Valparaiso, Ind., world's largest producer of permanent magnets.

The new permanent magnet, called Indox, is made from noncritical materials, iron oxide and barium carbonate, and goes through a number of critical cycles in powder preparation, pressing in dies and heat-treatment. It is the first new magnetic substance since the development of Alnico in 1931.

For Plating Anodizing, Bonderizing, Pickling, Cleaning and Rinsing Solutions



POWERS No. 11-MF Regulators insure most effective use from various solutions by holding them at the right temperature automatically. They save Steam and Labor.

Plastic Thermal Bulb and Tubing is highly resistant to solutions used in above processes. Prevents electrical shorts. No insulators required for the regulator.

Easy to Read 4" Dial Thermometer indicates temperature of liquid being controlled and makes it easy to adjust regulator for different temperatures.

Bulletin 330 fully describes this simple, self-operating regulator. May we send you a copy? (b30)

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Offices in over 50 Cities, see your Phone Book • Established in 1891

POSITION WANTED

Thoroughly experienced in all phases of Polishing, Buffing and Plating. Thirty-five years' experience in the use of all types of equipment including still, barrel, semi-, and full automatics. Have extensive experience in management, supervision, engineering, layout, development processes and specifications. Capable of installation and operation.

Salary commensurate with responsibility.

Would consider selling or service and will locate anywhere. Further information on request.

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TWO NEW
Barrel Zinc Brighteners

B-4...B-4M

with

- **High Brilliance and Depth of Color**
- **Excellent Covering and Throwing Power**
- **Low-cost Operation**

. . . simple, economical methods for producing brilliant zinc deposits on barrel work. These Promat processes will last longer and cost less to use.

Promat B-4 and B-4M Brighteners have been fully proven in production. Several large barrel plating companies have been using them for months with great success.

The average cyanide zinc plating solution can be converted relatively easily to either of the Promat Barrel Zinc Brightener Processes. For full details just drop a line to Promat. Our service organization is ready to serve you at any time, on any plating problem.

PROMAT
DIVISION

POOR & COMPANY
851 S. Market St., Waukegan, Illinois

Personals

James R. McBrien, assistant division manager of The Diversey Corporation's eastern division since 1949, has been named manager of the north central division.

McBrien joined Diversey in 1936 spending four years as a field representative in the East. His impressive record earned him promotions to district manager in 1940 and assistant division manager in 1949, eastern division. His new position will take him to Minneapolis—north central division headquarters.

Roger E. Marce has been appointed to the sales and service staff of Wagner Brothers, Inc., Detroit.

He will handle sales and service for the metropolitan Detroit district.

Marce has a widely diversified knowledge of metal surface preparation as a

Marce

result of 18 years of experience in this field. Most recently, he was a sales engineer for the Grow Solvent Co., and Technical Director for the Neilson Chemical Co.

Marce is a graduate of the Lawrence Institute of Technology, with a degree in Chemical Engineering. Among numerous activities in the chemical field, he has served as Editor of the "Anachem News", as Chairman of the Association of Analytical Chemists and as National Councilor for the American Chemical Society.

George Dubpernell, manager of the Waterbury laboratories of United Chromium, Inc., was honored at a luncheon at the Hotel Barclay in New York. The celebration marked Dr. Dubpernell's admission to membership in the Twenty Year Club of United Chromium.

Dr. George Dubpernell, Manager of the Waterbury laboratories of United Chromium, accepts watch presented to him by President Richard O. Leongard in honor of Dr. Dubpernell's entry into the Twenty Year Club of United Chromium

Dr. Dubpernell is best known for his contributions in the chromium plating field. He was co-inventor of a chromium plating barrel which has gained wide acceptance as an improved means for economical chromium plating of small parts.

Dubpernell was graduated in 1924 from

BRASS PLATING WITH TRUE BRITE

❶ improve color

❷ save labor

❸ eliminate supervision

❶ *color stays constant . . . no rejects*

❷ *eliminates frequent analyses . . .*

❸ *trouble free . . . only one addition instead of three*

Write for FREE bulletin: Your key to better Brass Plating

Available in regular 3 to 1 ratio for yellow Brass Plating.

Special ratio materials for plating richlow brass or any other desired alloy of copper and zinc.

Suitable for both still tanks and barrels.

TRUE BRITE CHEMICAL PRODUCTS CO.

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WANTED

Experienced sales executive who can assume full responsibility for Branch Office operation in mid-western city for a nationally recognized manufacturer of electroplating supplies and equipment. Challenging position has unlimited possibilities for capable man who can service established company accounts, direct activities of distributor sales organization and spur development of company prestige. Previous activity in area desirable but not essential. Salary open.

All replies confidential. Our employees know of this advertisement.

Reply to:

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"Controlled Compounds" in extruded bar and liquid to meet all requirements and conditions of any job.

the perfect liquid compound

Liquimatic®

for all finishing requirements on all metals

Check these features

- FAST CUTTING
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- ADHESIVE, SLOW WEARING BUFF FACE
- NON-SETTLING
- HIGH FLASH POINT
- LONG STORAGE LIFE
- SPRAYABLE VISCOSITY

J. C. Miller Engineers are fully qualified through technical training and years of practical experience to demonstrate and recommend materials and methods for use in your plant — materials and methods that pay you big dividends in higher production and increased savings.

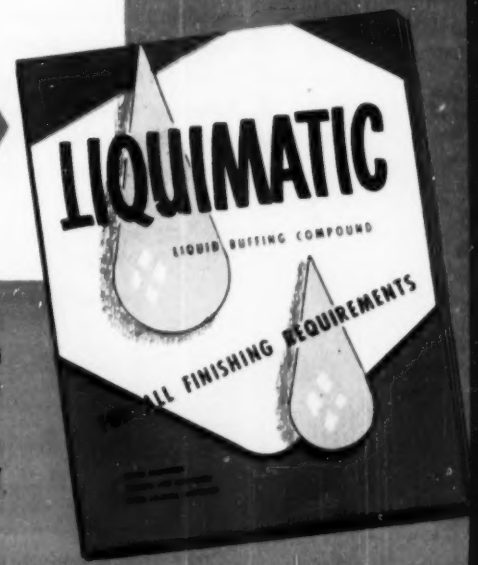
Our Buffing Engineers are equipped with portable Liquimatic demonstration kits which enable them to easily show you the savings that Liquimatic can effect in your plant — on your production line. This demonstration equipment is rapidly set up, requires no assistance from your help and the test can be made on hand lathes or automatic equipment using just a compressed air connection. The demonstration in no way impedes your normal production flow.

Here is a demonstration you should see regardless of past experience or whether or not you are using a liquid compound at present! We know that we can show you that we have achieved the maximum in performance through combining the very latest in automatic application equipment with the very best in compounds — Liquimatic. This is the Liquimatic team — an unbeatable combination.

Send today for your copy of the big, new Liquimatic and Liquimatic Automatic Equipment Brochure. It's full of valuable information for the metal finisher.

LIQUIMATIC . . .

LETS YOUR BUFFS LIVE LONGER



J.C. Miller Quality & Service

Manufacturers of

Tripoli • Stainless Steel Compound • Lime Finish • Cut and Color • Chrome Rouge • Greaseless • Grease Stick • Emery Cake • Burring Compounds

J. C. MILLER Company

631 Chestnut Street

GRAND RAPIDS, MICHIGAN

Personals

the University of Michigan where he was associated with **Professor E. M. Baker.** He then worked and studied under **Dr. Colin G. Fink** at Columbia University, receiving the A.M. degree from that institution in 1927. Returning to the University of Michigan, he studied under **Professor A. L. Ferguson** and earned the Ph.D. degree in 1933 for work on overvoltage.

Joseph P. Stanavage has joined the Research and Development Division of the Pennsylvania Salt Manufacturing Company and will work on projects of the Corrosion Engineering Products Department.

A chemistry graduate of the University of Scranton, Stanavage spent one year as a graduate assistant at Wesleyan University. He comes to Pennsalt from the General Chemical Division of Allied Chemical & Dye Corporation.

Joseph Lind, well-known combustion equipment sales engineer, formerly associated with the Carbomatic Corporation, opened an office for the Burdett Manufacturing Company of Chicago at 53 Park Place, New York 7, N. Y. Lind will represent the Burdett Manufacturing Company in sales of combustion systems and complete finishing systems, including ovens, spray booths, washers in metropolitan New York and the States of Connecticut and New Jersey.

Harry Kaplan, formerly of Organic Intermediates, and **Jesse Weiss,** formerly of Elbert & Co., have formed the Columbia International Corp., with offices at 200 Terminal Rd., Clark (Rahway), N. J.

The new organization is offering trichlorethylene and other chlorinated solvents, a full line of metal-finishing equipment and supplies, industrial solvents and chemicals, fine chemicals, and specialty intermediates.

Rodney E. Sagendorf has been named administrative assistant to **W. F. Newbery,** director of sales, the Detrex Corporation, Detroit, Mich.

Sagendorf

For two years, Sagendorf has been chief of the chlorinated solvents section, Chemical Division, of the NPA, Washington, D. C.

Sagendorf was with the Packard Motor Car Company in New York from 1938 to 1942, when he joined Detrex as Manhattan representative. He was loaned to the government for 4 years during the war, returned to Detrex in 1945 to become expediter for the company's purchasing department, later was placed in charge of the general sales office, and then became the company's Ohio representative for two years before joining the NPA.

Check these Cleaning Results

of an eastern job plating shop

- ✓ Greatly improved results over vapor degreasing... resulting in better plating.
- ✓ Cost of cleaner reduced by 80%.
- ✓ Steel parts protected against rust up to two days.
- ✓ Elimination of hazardous vapors.
- ✓ Greater production through faster cleaning.
- ✓ Complete removal of metal chips from work.
- ✓ Low initial cost — low upkeep.

All these results are obtained with the Magnus Aja-Lif Method of cleaning. Write for details.

FOR THE DIFFICULT

Before you decide on *any* cleaning equipment, investigate the Magnus Methods designed for difficult cleaning.

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MAGNUS CHEMICAL CO., INC.

41 South Ave., Garwood, N. J.

In Canada: Magnus Chemicals, Ltd., Montreal

Service Representatives in Principal Cities

SALESMAN WANTED

Excellent opportunity for a well qualified sales representative with entree to users of industrial cleaners, paint strippers and allied chemical specialties. Advertiser, located in the Metropolitan area, is a small growing concern with an excellent reputation and record of achievement. All replies will be held in the strictest confidence and an appointment at your convenience will be arranged.

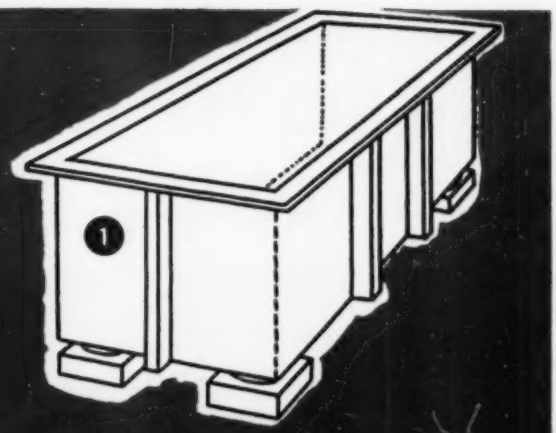
Reply to:

P-254-E, PLATING
445 Broad St., Newark 2, N. J.

Salesman wanted metropolitan area N.Y.C. Electroplating background preferred. Draw plus Commission. Excellent opportunity for right man. *Reply to:*

P-254-F, PLATING
445 Broad St., Newark 2, N. J.

Three Simple Steps *for* LOWER Tank Maintenance COSTS



Whether you line your tanks with rubber, plastic, brick, tile, lead or use them unlined, here are three simple steps you can take that will assure you longer tank life, lower maintenance costs:

1. Wherever possible see that tanks are installed with adequate air space underneath, and that all exterior surfaces are accessible for cleaning.

2. Coat all exterior surfaces, including the bottom, with Tygon Corrosion-resistant Paint — the all-plastic coating resistant to acids, alkalies, oil, water and alcohols. Don't be stingy. Do the job properly. Apply a coat of Tygorust, the "no-prep" rust inhibiting vinyl primer, and three coats of Tygon Paint.

3. Clean and inspect the outside shell occasionally. The glossy Tygon surface cleans easily. If you find a scratch or break in the film caused by carelessness, touch it up with fresh Tygon Paint. The job will be as good as new.

Wherever you have wood, metal or concrete surfaces exposed to the corrosive fumes, gases or spillage — protect them with Tygon Plastic Paint coatings. You'll lengthen the time between recoatings 50% to 500%. And Tygon Paint costs no more than coatings that offer less than half the life.

Tygon plastic paint coatings are pure plastic in a solvent vehicle. Applied cold by spray gun or brush, they dry to form a tough plastic film, resistant to the attack of acids, alkalies, oils, alcohols or water.

•

Tygon Paint films bond tightly to metal, wood or concrete. They do not oxidize, show no chemical deterioration with age. Tygon Paint films are flexible and tough; resist impact without chipping or flaking.

•

Tygon Paint films are non-flammable when dry, possess excellent dielectric strength.

U. S. STONEWARE

Akron 9, Ohio

Tygorust primer and Tygon paint is a system that's hard to beat for chemical resistance, and long maintenance-free life.

Koppers Potassium Cyanide Solution

HANDLING potassium cyanide granules is dangerous, troublesome, and time-consuming. It necessitates dissolving, drum storage, drum cleaning, and disposal of potentially dangerous, half-cleaned drums. And it needlessly exposes working personnel to poisonous cyanide powder dust.

With Koppers Potassium Cyanide in solution form, these risks are minimized. The solution is delivered to you by tank truck, pumped directly from the truck into your storage tank, ready to use, or in 55-gallon drums from which the final traces of solution can easily be removed by a water wash. No preparation is necessary.

Koppers Potassium Cyanide, 35-40%, is widely employed in electroplating where copper is used as a base coat for chromium plating. It forms soluble complexes with copper, silver, gold, cadmium, zinc, and other metals of the general form $E_2M(CN)_3$ or $K_2M(CN)_4$. It possesses extremely low sulphur content and high purity.

Due to its time- and labor-saving convenience, Koppers Potassium Cyanide solution is *actually less expensive* than its solid counterpart.

Potassium Cyanide is one of the many synthetic chemicals produced by Koppers, including Resorcinol, Styrene Monomer, Polystyrene, Phthalic Anhydride, Divinylbenzene, and Di-tert-butyl-para-cresol.

KOPPERS COMPANY, INC.
Chemical Division, Dept. P-24, Pittsburgh 19, Pennsylvania

KOPPERS ® **Koppers Chemicals**

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CHICAGO · DETROIT · LOS ANGELES

Personals

J. Robert Greenwell was General Conference Chairman of the First Management Seminar, sponsored by National Federation of Metal Finishers and held January 30, 1954 at Conrad Hilton Hotel, Chicago, Ill.

Greenwell

In announcing the details of the event, Greenwell explained that the need for such seminars is growing rapidly with the changing economy. "The NFMF feels that management leaders in the metal finishing industry can profit through the free exchange of ideas, methods and techniques being applied in other industries."

A second management seminar is being planned for July in New York City to be held during the 41st Annual AES Convention.

OBITUARY

The Masters' Electro-Plating Association records with great sorrow the death of their beloved Treasurer, **Irving Berkman.** He died at the Montefiore Hospital in New York City on December 10, 1953. He was 48.

Berkman

In 1930, Berkman, with his brother Herman as a partner, organized the job-plating firm of Berkman Bros., Brooklyn, N. Y.

In 1935, he joined the Masters' Electro-Plating Association of New York City and in a short time, because of his intense interest in the welfare of the plating industry and his sincere devotion to the Association, was elected to the Executive Committee. He served on the Committee variously as Chairman, Vice-Chairman and Treasurer.

On October 27, Berkman was awarded the "Plating's Man of the Year" award.

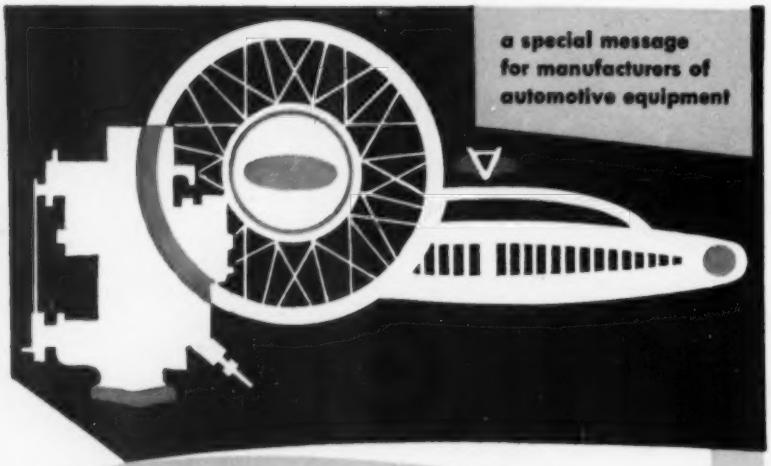
The name Udylite on plating equipment is your guarantee of painstaking research, modern design and precision manufacture. It is your assurance, too, of never-ending service—your warranty far beyond any statement of guarantee.

But, in addition, highest quality plating supplies must be used with good equipment for best results. That's why Udylite plating supplies are so important to you. High quality . . . rigid control . . . is your assurance that Udylite plating supplies plus Udylite equipment give the finest results in the plating industry.

There is no better way of plating than the Udylite way. Put it to work for you. Let the Udylite Technical Man give you all the facts.

PIONEER OF A BETTER WAY IN PLATING

THE Udylite CORPORATION
DETROIT 11, MICHIGAN



need a finish for low cost corrosion protection or showroom sparkle?

specify IRIDITE®

Whether you're finishing non-ferrous parts for high corrosion protection, paint base, or for showroom sales appeal, you can be sure of low material and production costs and peak performance when you specify Iridite. Here's what you can do with Iridite:

- **ON ZINC AND CADMIUM** you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.
- **ON COPPER . . .** Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.
- **ON ALUMINUM** Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.
- **ON MAGNESIUM** Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

WANT TO KNOW MORE? We'll gladly treat samples or send you complete data. Write direct or call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

Iridite is approved under government specifications

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Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals, ARP Plating Chemicals.
WEST COAST LICENSEE: L. H. Butcher Co.

Trade Literature

L—200. Bulletin on New H-VW-M Rectifier—A new heavy-duty, selenium rectifier specially designed for use in plating and other metal-finishing operations is pictured and described in a new bulletin offered by Hanson-Van Winkle-Munning Co., Matawan, N. J. Besides combining a number of desirable features in one design, this rectifier is uniquely equipped with terminal tie-bars that permit output voltage to be changed without any change in a user's bus arrangements.

The 4-page, two-color bulletin tells what type of current and ripple is delivered by the rectifier. It gives information on models, costs, operating capacity, various sizes the unit comes in, type of input and kind of current switching.

Instruments and parts of the unit are pointed out on large exterior and interior photographs. Individual close-ups are given of the resetting starter, calibrated thermostat, updraft fan, custom-built selenium stacks and heavy-duty transformers. For copies of the bulletin, use Reader Service Card.

L—201. Instrument Transformer Buyer's Guide—The 1954 edition of the G-E Instrument Transformer Buyer's Guide, containing basic, up-to-date information on the complete General Electric line, has been announced as available from the Company at Schenectady 5, N. Y.

The fully illustrated, 96-page publication, GEA-4626G, contains ratings, ASA accuracy classifications, and prices of all G-E indoor and outdoor potential and current transformers. Listings of ratio and phase-angle tests, together with tables covering the mechanical and thermal limits of current transformers, are included. For your copy, use Reader Service Card.

L—202. Mixed-Bed Water Demineralizer Bulletin—The Barnstead Still & Sterilizer Company, 228 Lanesville Terrace, Forest Hills, Boston 31, Mass., announces a new line of mixed-bed water demineralizers featuring the latest engineering developments in the ion exchange process of water purification. Included is an improved system for regeneration of the purifying resins after they have become exhausted. Capacities run from a range of 50 to 2,500 gallons of mineral-free water per hour.

The booklet describes how impurities such as sodium, calcium, potassium, magnesium, iron, copper, chlorides, sulfates, bicarbonates, carbonates are eliminated

WILLIAMSVILLE BUFF DIVISION
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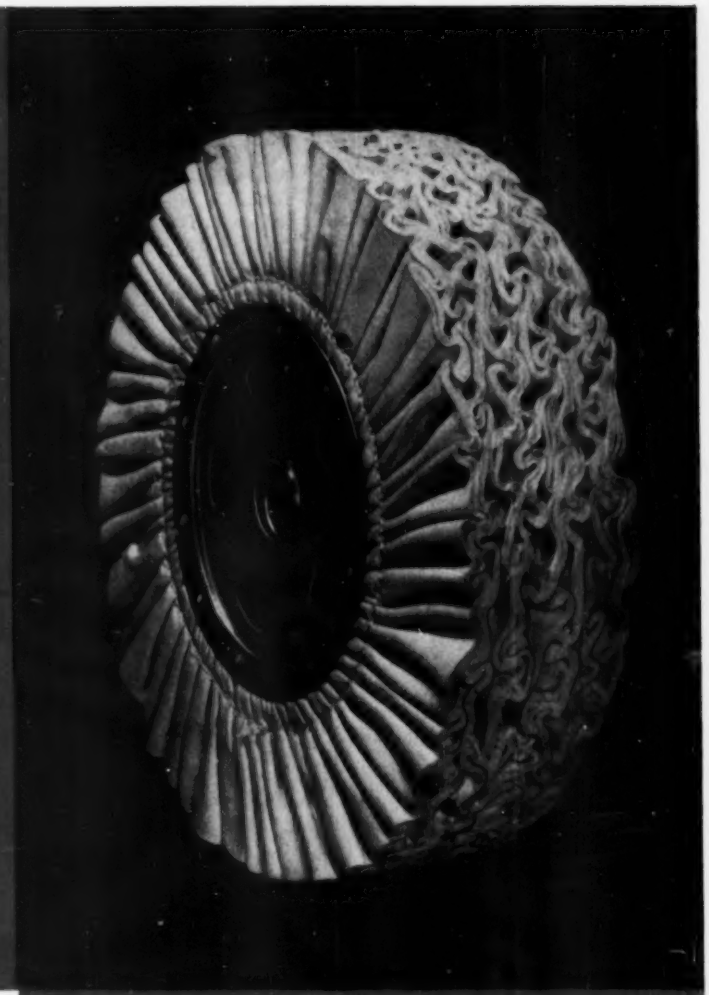
DANIELSON CONNECTICUT

NOW for Automatic Buffing



LET THE FAMOUS Williamsville CUTMASTER

- Precision-engineered for perfect balance throughout
- Perforated steel center gives cool running at highest speeds
- Cut on the bias for extra life
- High-count long fibre cotton will not fray or ravel

GIVE YOU LONGER SERVICE . . . GREATER PROTECTION!

For over half a century, Williamsville Buffs have boosted production — cut overhead costs — in plants all over the country. Ask us for the answer to your buffing problems now — write, wire or phone!

WILLIAMSVILLE BUFF DIVISION
The Bullard Clark Company

DANIELSON • CONNECTICUT

Trade Literature

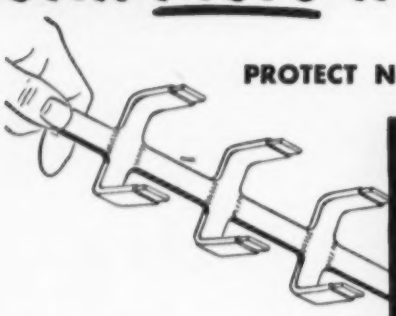
to result in an effluent water of very high electrical resistance, often up to 20 megohms per cc. For your copy of this literature, use Reader Service Card.

L—203. Furnace and Oven Control Catalog—A new, greatly expanded catalog of complete control systems for furnaces, ovens, dryers, and kilns has been announced by The Bristol Co., Waterbury 20P, Conn. The new book contains all the detailed engineering specification necessary to choose the proper control "package" for a particular installation. Several models of potentiometer and millivoltmeter type pyrometer controllers, recorders and indicators, as well as bulb-and-tubing recording or controlling thermometers are described and pictured. More than 100 photos and application and dimension drawings illustrate the 48-page bulletin. For your copy, use Reader Service Card.

L—204. Portable Fume Washer—A new bulletin, released by the U. S. Stoneware Co., Process Equipment Division, Akron 9, Ohio, describes and illustrates the "Cyclonaire," the portable fume washer for low-cost fume removal in plants and laboratories.

Complete technical data, drawings, performance charts, and dimensional information on the compactly built "Cyclonaire" make this a helpful booklet for all engineers concerned with fume removal problems. Readers can obtain copies of this new bulletin by using Reader Service Card.

How to cut costs still more with "218X"



PROTECT NOT ONLY RACKS . . .

COATING 218X is so tough, so long-lasting a coating that the more you use it, the more money-saving protection you get. Of course, you derive the biggest benefit from the outstanding application for Coating 218X – protection of racks.

This green plastisol stands up in all cleaning, plating, and anodizing solutions—even vapor degreasing cycles. It resists impact and abrasion without chipping, cutting or damage. In short – it means minimum rack coating costs.

You can do the same on this other equipment:

- Plating barrels
- Drain boards
- Anode hooks
- Tank screens
- Tote boxes
- Dipping baskets

—all these and more can be protected longer, and with less maintenance expense, by means of the same Coating 218X you use for racks.

Make more use of your Coating 218X —you'll find *many* places where it can save you money, time and equipment. We'll be glad to tell you how to apply it.

UNICHROME Trade Mark COATINGS for METALS

Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

Products of UNITED CHROMIUM, INCORPORATED

100 East 42nd St., New York 17, N.Y. • Detroit 20, Mich. • Waterbury 20, Conn. • Chicago 4, Ill.
Los Angeles 13, Calif. • In Canada: United Chromium Limited, Toronto, Ont.

L—205. Bulletin on Buna N and Hard Rubber Pumps, Valves, Fittings—Vanton Pump & Equipment Corp., Empire State Building, New York City, has released an informative 4-page bulletin describing its Buna N and natural hard rubber pumps, valves and pipe fittings manufactured specifically for the chemical process and allied industries. Physical property and chemical resistance data are contained, together with illustrations, performance data tables and specification charts. For your copy of this bulletin, use Reader Service Card.

L—206. Technical Literature—Typical uses, properties and methods of applying Bakelite vinyl resin-base organosols, plastisols and plastigels are presented in a new, 8-page booklet published by Bakelite Company, a Division of Union Carbide and Carbon Corp., 300 Madison Ave., New York 17P, N. Y.

The illustrated booklet presents 15 typical applications, such as dish drainers, anatomical models, and metal chair coatings. For your copy of this booklet, use Reader Service Card.

L—207. All Purpose Industrial Cleaner—The Chemical Detergents Company, Inc., 27P William St., New York 5, N. Y., have issued a new folder describing Planisol, their all purpose cleaner. Planisol is a noncaustic, nontoxic detergent that decreases and removes most anionic drawing compounds and a great number of the common soils such as grease, dirt and grime that are found in the plating industry. Planisol may be used in concentrations as low as 2 oz/gal as compared to the caustic based cleaners using 8 oz or more per gallon. For your copy of the folder, use Reader Service Card.

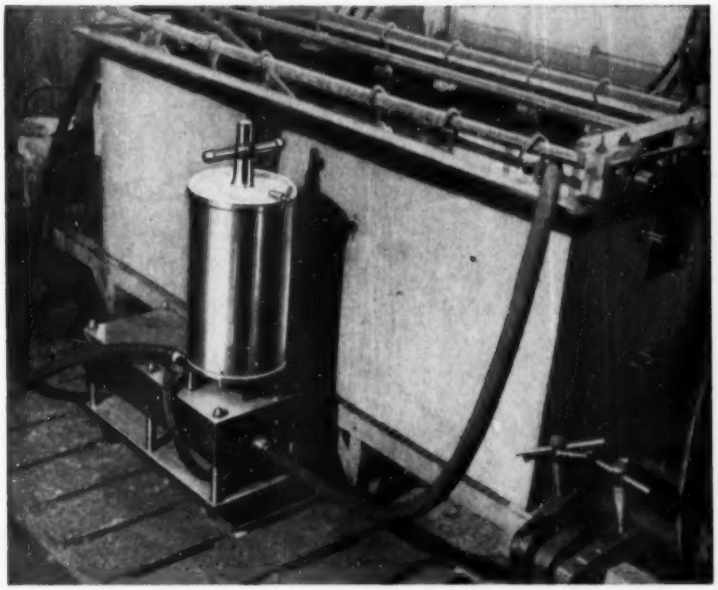
L—208. Electric Oven Catalog—For analytical and general laboratories, pilot plants, and production, a new 40-page catalog on electric ovens, furnaces, glass annealing ovens, utility water baths, humidity cabinets, and incubators recently was published by the Blue M Electric Company, 306P W. 69th St., Chicago 21, Ill. Units are used in chemical, plastics, metallurgical and automotive fields, electronic research, rubber industry for drying, baking, preheating, conditioning, and tempering. Copies are available upon request; use Reader Service Card.

L—209. Respirator Data Sheet—Economy and comfort are said to be outstanding features of a new, inexpensive single-cartridge "Gasfoe" respirator being announced by Mine Safety Appliances Company, Pittsburgh, Pa., and described in a new bulletin.

All seven parts are independently replaceable, so that long service life is as-

Here's how to cut your losses

get better finished plated work — save time and labor



The "Sealed-Disc" Filter will remove all dirt, dust, and sludge from your plating solutions. You'll no longer worry about pitting, spotting, poor adhesion, formation of nodules, etc.

More and more platers testify to the remarkable savings in operating time and labor that the "Sealed-Disc" Filter gives them. These cost-minded platers get better finished plated work and have found that their solutions last longer. "Sealed-Disc" Filters, designed to meet plating room requirements, are smaller, more compact and portable, than ordinary conventional filters.

Regardless of the size or type of your installation, there's a "Sealed-Disc" Filter to "fit your job." You can depend on a "Sealed-Disc" Filter for positive, trouble-free performance that's proof against even the invisible impurities that cause nodules and porousness, proof against losses caused by rejects and reworking. Write for complete details or contact your regular plating supplier.

ALSOP
ENGINEERING CORPORATION
902 Fine Street — Milldale, Connecticut

Other Alsop Plating Room Equipment

We manufacture a full line of Mixers and Agitators covering a complete range of sizes, for mixing, blending, and dissolving. Stainless Steel Mixing Tanks are also available in a wide range of capacities. For full details and illustrations write for your free catalog.

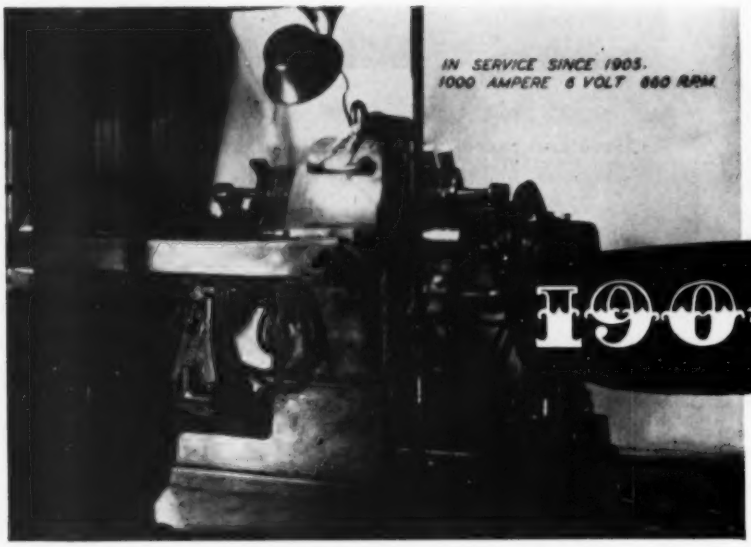
GOLDEN

1904 Chandeysson 1954

JUBILEE

50 YEARS

OF SPECIALIZING



1904 1954

One of the early Chandeysson generators still in use.

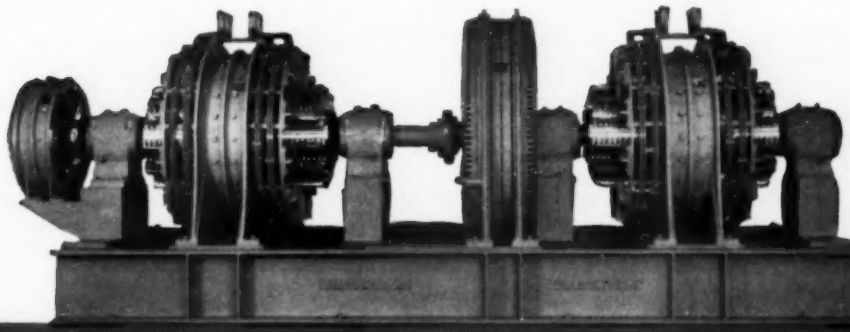
CHANDEYSSON ELECTRIC COMPANY

4078 BINGHAM AVENUE, ST. LOUIS 16, MISSOURI

Dr. Pierre Ismail Chandeysson,
founder of the company. 1875-1953

HAS MADE Chandeysson MOTOR-GENERATORS

the most efficient, most dependable for Electrolytic Applications



A modern Chandeysson generator built for one of the country's largest automobile manufacturers.

During all these 50 years, quality has never been compromised in a Chandeysson product. Only the best in materials and workmanship could create generators with such high quality that some of the original generators are still giving satisfactory performance today.

It has always been—and shall continue to be—the Chandeysson policy to build sturdy products with overload capacity that permits you to meet emergencies without damage to your power conversion equipment.

Many hundreds of America's most prominent industrial producers such as large automobile companies and their component suppliers, have chosen Chandeysson Generators to serve their needs where constant production, without interruption, is an absolute requirement.

Chandeysson products are sold through distributors with experience and training that may be of value to your technical staff. Write for your distributor's name.

A number of the cleaning and plating tanks in Wyandotte's new Industrial Research Laboratories.

Your Electrocleaning SAVINGS
START HERE!

This picture is very significant! It shows you some of the 18 tanks in Wyandotte's new metal-cleaning and electroplating laboratory.

Here, Wyandotte's high-quality, low use-cost products are tested and evaluated on problems just like yours. Development work is constantly in progress to improve these products and formulate new ones. Wyandotte's leading electrocleaners for trouble-free performance prior to electroplating are:

B. N. for electrocleaning ferrous and nonferrous metals, including buffed nickel. Maximum flexibility for different metals.

C. S. R. for final anodic (reverse) electrocleaning of ferrous metals. Meets specifications requiring no silicates, soaps or wetting agents. Outstanding removal of carbon smuts.

F. S. for heavy-duty anodic electrocleaning of ferrous metals before electroplating. Exceptional detergency and soil tolerance.

NO. 90—a heavy-duty, reverse-current electrocleaner designed primarily for removing fabricating compounds and smut from ferrous parts. Also used on copper. Has exceptional tolerance to chrome contamination.

With these unsurpassed service facilities, equipment and products, and the know-how of Wyandotte technical representatives, we can recommend the electrocleaner to do *your job best* at the *lowest use-cost*.

Insist on quality preparation for electroplating of your quality products. See how you can profit from Wyandotte's new, improved electrocleaning products and techniques. Mail the coupon today . . . there is no obligation. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Angeles 12, California.*

Wyandotte CHEMICALS

Helpful service representatives in 158 cities in the United States and Canada

Largest manufacturers of specialized cleaning products for business and industry

Wyandotte Chemicals Corporation
Department 2187
Wyandotte, Michigan

Please send free technical information on:

☐ B. N. ☐ C. S. R. ☐ F. S. ☐ NO. 90
☐ Please have a representative call.

Name _____

Firm _____

Address _____

City & Zone _____ State _____

Trade Literature

sured. The cartridge, which contains treated charcoal fill, is designed to protect the wearer against nuisance concentrations of organic vapors, and certain acid gases having obnoxious but relatively harmless odors. For your copy of the data sheet, use Reader Service Card.

L—210. Multi-Purpose, Plastic Closures—Colorful, red CaPlugs are finding new uses every day to protect threading, tubing ends and fittings of all types of products and parts during processing, storage and transit. Molded of tough, flexible polyethylene plastic, they are impervious to all common chemical reagents, such as solvents, sterilizing agents, caustic and acid baths, and will not chip, break or shred under severe conditions, reports Protective Closures Co., Inc., 2207P Elmwood Ave., Buffalo 22, N. Y., the manufacturer.

Introduced as non-threaded closures, standard CaPlugs, looking like red thimbles in smaller sizes and bottle or jar caps in larger sizes, push on easily over pipe or tubing ends as caps or insert readily in round openings as plugs. Ideal as dust and moisture seals and shipping protectors for delicate fittings, they are used also as dipping process inserts and for masking of threads and parts during paint spraying and plating.

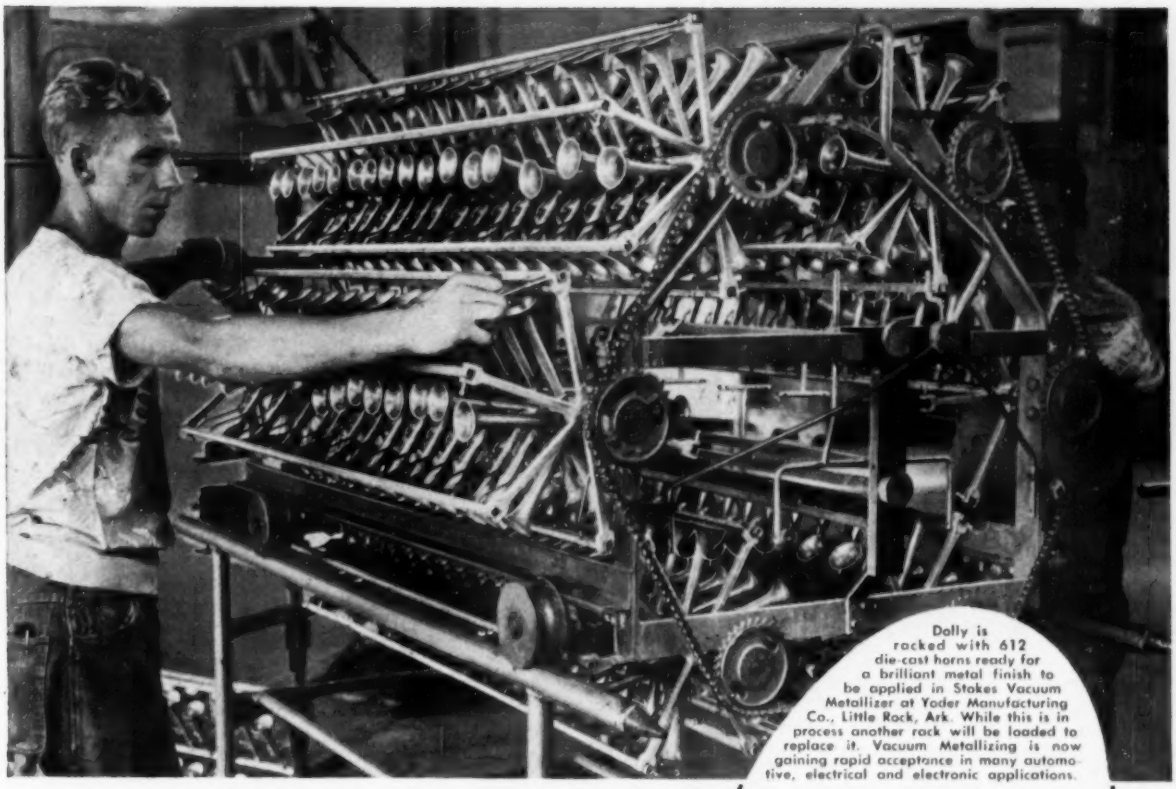
An assortment of sample CaPlugs (both threaded and plain) and descriptive literature are available. Use Reader Service Card.

L—211. Vaneaxial Blower Bulletin—Direct-drive vaneaxial blowers, three types of belt-drive vaneaxial blowers and a special portable blower for exhausting fumes from tanks are described in a new bulletin issued by the Hartzell Propeller Fan Co., Piqua, Ohio.

The 16-page brochure includes dimension drawings and figures and complete air delivery tables for all of these blowers. Two of the belt-drive models, a high-temperature blower and a new design for low-volume, high-pressure requirements, are new lines which have not been shown in any previous catalog. For your copy of the bulletin, use Reader Service Card.

L—212. Prefinished Metals—A new 8-page brochure on Prefinished Metals is now available from Apollo Metal Works, 66th Place and S. Oak Park Ave., Chicago 38P, Ill.

The metals described in the brochure include six base metals, three finishes, four plating metals, three types of surfaces and three forms. A general data table of properties and characteristics also is included. For your copy, use Reader Service Card.



Dolly is racked with 612 die-cast horns ready for a brilliant metal finish to be applied in Stokes Vacuum Metallizer at Yoder Manufacturing Co., Little Rock, Ark. While this is in process another rack will be loaded to replace it. Vacuum Metallizing is now gaining rapid acceptance in many automotive, electrical and electronic applications.

In Minutes These 612 Die-cast Horns will be Brilliantly Metal-coated!

Metallic finishes in many metals and many colors are now applied by Vacuum Metallizing and the product is ready for lacquering and packaging without hand work. No plating or finishing plant can afford to ignore the tremendous opportunities which Vacuum Metallizing creates.

Ornaments and display materials, toys, trophies, furniture handles, emblems, jewelry, nameplates, reflectors and many other metal parts are now largely vacuum metallized. Automobile parts are a new and fast-growing market. Electrical and electronic parts offer unlimited possibilities. Some installations deliver as high as 100 loads of finished parts per 24-hour day from a single Stokes Vacuum Metallizing unit without use of specially skilled labor. Stokes trains your workmen and you start into production.

Units of 24, 36, 48 and 72-inch diameter are available, some fully automatic in operation. Floor space requirements are low, as these are integrated "package" units of the fastest and most efficient type.

Stokes Laboratory will metallize your samples, evaluate your application, recommend techniques to be employed, plan cycles, report on costs . . . and share with you the benefits of Stokes' 40 years of leadership in high-vacuum technology.

Write today for a comprehensive brochure, "Vacuum Metallizing Today," which describes the applications and techniques of Vacuum Metallizing.

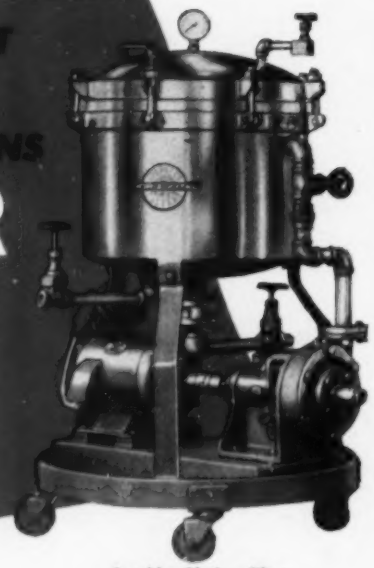
F. J. Stokes Machine Company
Philadelphia 20, Pa.

STOKES

STOKES MAKES: High Vacuum Equipment, Vacuum Pumps and Gages / Industrial Tabletting, Powder Metal and Plastics Molding Presses / Pharmaceutical Equipment

FOR LOW COST FILTERING OF PLATING SOLUTIONS

SPARKLER HORIZONTAL PLATE FILTERS



Sparkler Plating Filter
Model 18-D-6 Alliron
600 G.P.H. Portable

HERE'S HOW

★ On a horizontal filter plate it is possible to apply a thin pre-coat with about one-third the filter aid, and in one-third the time required for pre-coating a non rigid media or a surface in a vertical position. This saves time and filter aid.

★ With the Sparkler horizontal plate you can apply this thin pre-coat evenly over the entire plate surface and start filtering immediately with less pressure and obtain maximum consistant clarity right from the start up to the end of the cycle.

★ A filter cake on a horizontal plate will not crack, slip or fall off even with varying pressure or a complete shut-down of the filter. No pre-coat renewal is ever required after an interruption in operation.

★ When it is necessary to clean the filter, the Sparkler filter tank can be emptied in a matter of minutes with a minimum of loss of valuable plating solution.

★ Any grade of filter paper from fine to coarse can be used in a Sparkler filter. This makes it ideal for carbon treatment of solutions. Carbon mixed with water in a stand-by tank is circulated through a clean set of filter paper on the plates until a carbon cake is formed. The solution requiring carbon treatment is then circulated through the carbon beds without contaminating the plating tank or a shutdown of plating operations.

★ At the end of the cycle with a Sparkler filter you can blow-down with air and produce a relatively dry cake that can be disposed of in a trash can rather than washing it down the drain with attendant sewer clogging problems.

★ You will find your Sparkler plating filter positive and dependable from a standpoint of uniform high quality filtering and economical in labor and material.

SPARKLER

Sparkler representatives in all principal cities are ready to give you personal service on your filtering problems, and show how you can make a material saving in operating cost.

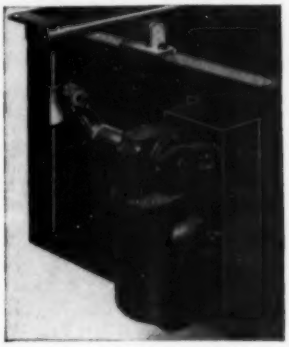
MANUFACTURING COMPANY
Mundelein, Illinois

Sparkler International Ltd.
Prinsengracht 876, Amsterdam, Holland

Sparkler Western Hemisphere Corp.
Mundelein, Ill. U.S.A.

Equipment and Supplies

E—213. Vertically Mounted Rod Agitator for Plating Racks—Important saving in clearance required for mounting is achieved by a new rod agitator announced by Belke Manufacturing Company, 947 N. Cicero Ave., Chicago 51P, Ill.



The new unit is vertically mounted. Operation requires but 12 inches beyond the end of the tank compared to 24 inches required by normal, present day models—very necessary when tanks are close to wall or close to each other.

The new agitator is available in single and double rod types, and is powered by a ¼ horsepower geared head motor drive unit with fully enclosed gears operating in oil. The standard speed is 17 strokes per minute with a stepless stroke adjustment from 3½ to 8 inches. For more information, use Reader Service Card.

E—214. Multiple Purpose Barrel Finishing Compound—A new multiple purpose barrel finishing compound said to produce brighter finishes in less time on a very wide range of metals has been introduced by Minnesota Mining and Manufacturing Co., St. Paul, Minn.

Called "Honite" brand Multi-Burnish compound, it can be used for burnishing operations where three or four conventional compounds were previously required. In addition, it can be used with all types of barrel finishing media.

As a result, reductions in burnishing costs up to 50 per cent are possible using the versatile new compound, according to the 3M company.

During the first part of the operating cycle, the new compound acts as an effective cleaner and permits rapid deburring. It then develops progressively richer suds which act both as a lubricant and as effec-

Remote control station for use with basic rectifier

Rectifier with built-in automatic programming

Teamed for Anodizing

SELENIUM RECTIFIERS and VOLTAGE REGULATORS FOR AUTOMATIC PROGRAMMING

- **Precision Engineered**
- **Rated for Continuous Duty**
- **Built to Last**
- **Fully Guaranteed**

In the anodizing process, the voltage must start low, and gradually build up as the oxide coating forms on the work. A dependable source of DC power is needed, along with good specialized controls.

Rapid Electric Selenium Rectifiers and Automatic Voltage Regulators "team" to meet every anodizing power requirement.

With Rapid Electric Automatic Voltage Regulators, the output of the rectifier can be controlled to follow any preset program of voltage or current variations automatically, thereby greatly reducing the amount of attention and supervision needed.

Rapid Electric Selenium Rectifiers are widely known for their high efficiency, maintenance-free, dependable service.

Our engineering department is available for consultation on any application of Direct Current Power Supplies. Avail yourself of this professional service without obligation.

THE NAMEPLATE THAT MEANS *"More Power to You!"*

RAPID ELECTRIC COMPANY

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Available for Immediate Shipment, Attractive Values

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

PLATERS

1—7500/3750 AMPERE, 6/12 VOLT, **MUNNING** "OPTIMUS."
1—5000/2500 AMPERE, 8/16 VOLT, **ELECTRIC PRODUCTS,** 25° C., Synchronous, Exciter-in-head.
1—5000/2500 AMPERE, 9/18 VOLT, **COLUMBIA,**
1—5000/2500 AMPERE, 7/14 VOLT, **CHANDEYSSON,** 25° C., Exciter-in-head.
1—5000/2500 AMPERE, 6/12 VOLT, **CHANDEYSSON,** 25° C., Synchronous, Exciter-in-head.
1—4000/2000 AMPERE, 6/12 VOLT, **CHANDEYSSON,** 25° C., Synchronous, Exciter-in-head.
1—3000/1500 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS,** Synchronous, Exciter-in-head.
1—3000/1500 AMPERE, 6/12 VOLT, **COLUMBIA,** Synchronous.
1—2000/1000 AMPERE, 8/16 VOLT, **ELECTRIC PRODUCTS.**
1—1500/750 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING,** Synchronous, Exciter-in-head.
1—1500/750 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.
1—1000/500 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS.**

ANODIZERS

1—4000 AMPERE, 40 VOLT, **CHANDEYSSON,** Exciter-in-head.
1—1000 AMPERE, 30 VOLT, **IDEAL,** Exciter-in-head.
1—1000 AMPERE, 40 VOLT, **CHANDEYSSON,** 25° C.
1—500 AMPERE, 25 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.
1—400 AMPERE, 40 VOLT, **M. G. C.,** Exciter-in-head.

RECTIFIERS

BRAND NEW BASIC RECTIFIERS, 1500/750 amperes, 6/12 volts. Special Price: $750.00 each. Separate Voltage Controls available.
1—2000 AMPERE, 6 VOLT, **G. E.** COPPER OXIDE, and Control.
1—**GREEN SELECTROPLATER,** 1800 AMPERE, 12 VOLT, 220/3/60.
1—**UDYLITE-MALLORY,** 1500/750 AMPERE, 6/12 VOLT, and Control.

SPECIAL

1—**MERCIL** 12 x 12 CENTRIFUGAL DRYER, Electric Heat.
1—**KREIDER** 12 x 12 CENTRIFUGAL DRYER, Steam Heat.
1—**CROWN** 18 x 18 CENTRIFUGAL DRYER, Steam Heat.
4—24" and 30" **ROBBINS & MYERS** 2-SPEED VENTILATING FANS.
3—No. 1 **HARTFORD** TRIPLE-ACTION BURNISHING BARRELS, Lined and Unlined, Belted.

Above is partial list only. Write to us for all your requirements for Plating, Anodizing and Metal Finishing

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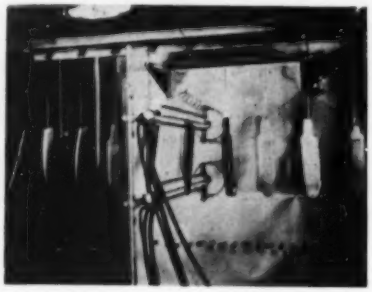
85 WHEELER STREET

Kirkland 7-5460 **CAMBRIDGE 38, MASS.**

Equipment and Supplies

tive suspending agent, resulting in high luster and brilliant color to the work pieces. For more information, on this product, use Reader Service Card.

E—215. Paint-Spray Equipment—Scientific Electric, of Garfield, N. J., demonstrated their revolutionary new Ionic gun and Ionic high potential paint spray equipment at the National Metal Exposition in Cleveland, Ohio.



The new Ionic high potential paint spray equipment is designed to electronically charge the paint within the spray apparatus itself.

This new method, according to the manufacturer, makes obsolete older types of equipment which require the use of external electrically charged screens to ionize the paint.

With the Ionic gun, paint becomes highly ionized and is therefore able to penetrate into cavities and crevices which would ordinarily require a great deal of hand touch up. Much less paint is actually used in operation and product quality is increased significantly. The actual savings of paint in most cases amounts to over 60 per cent of the paint used by conventional methods which do not produce uniform application of paint, thus causing excessive paint loss and innumerable rejections.

For more data on this product, use Reader Service Card.

E—216. Metal Surfacing Technique—A new method of treating metals to produce surfaces of greater uniformity than possible with conventional surfacing techniques has been announced by the American Metaseal Manufacturing Corp. of West New York, N. J. Known as "Metalblast", the new process applies the theory that controlled surfaces are better than "super-smooth" surfaces to reduce friction, dissipate heat, and prevent moving metal parts from seizing, sticking, or burning.

As a process, Metalblast consists of

PLA-TANK® TANKS

Built in One Piece to Stay in One Piece

Strong, lightweight Pla-Tank Resin-Bonded Glass Laminate Tanks are now — and always have been — molded in one piece. Several years ago we started making tanks over a mold after our engineers recommended this as the best production method. Since then, our customers have been telling us that you can't beat one-piece construction.

Frankly, we could assemble sheets and corners for less money — but we sincerely believe they'd be worth lots less as a tank.

One-piece PLA-TANK tanks take more abuse . . . last longer. There's no chance of coming apart at the seams. And PLA-TANK gives you a homogeneous tank wall as opposed to tanks with varying resistances due to adhesives used in the corners. Personal attention during manufacture to each square inch of surface insures against weakening dry spots and brittle resin build-ups.

269 STANDARD SIZES AVAILABLE

Even though individual molds are used, we can offer 269 standard sizes of cylindrical and rectangular tanks . . . all available for quick delivery without mold charges!

You can be sure of better, longer service with PLA-TANK — the FIRST name in Chemical Resistant Laminates.

Write for free data file sheets

THE *Chemical* CORPORATION

57 Waltham Ave., Springfield 9, Mass.

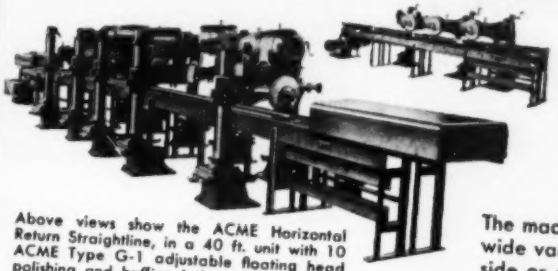
ACME *Automatics* PUT POLISHING *and* BUFFING OPERATIONS *on a low cost production basis . . .*

ACME *Semi-Automatics*

ACME Semi-Automatics are built to "deliver the goods." They can be fully relied upon to cut finishing costs, maintain production levels and stand up under long hours of operation!

The three ACME Semi-Automatics above are from left to right, the ACME A-2, a 2 spindle hand indexing machine for polishing and buffing cylindrical parts up to 12" diameter . . . the ACME L-4, a 4 spindle automatic indexing machine with a normal range of 250 to 400 indexes per hour . . . and the ACME D-10, an oscillating machine for finishing out of round parts. These machines are proved producers.

WRITE FOR CATALOG ILLUSTRATING WIDE RANGE OF TYPES



Above views show the ACME Horizontal Return Straightline, in a 40 ft. unit with 10 ACME Type G-1 adjustable floating head polishing and buffing lathes . . . and a 20 ft. unit with 3 ACME Type G-3 lathes.

ACME *Straight Lines*

ACME Straightlines provide effective solutions to many finishing problems. ACME progressive experience and engineering assure dependable performance at high production levels.

The machine illustrated is unusually versatile and adaptable to a wide variety of work. It may be loaded or unloaded from either side or either end. Polishing and buffing heads may be used on either or both sides and may vary in number to suit the required production and finish.

WRITE FOR OUR STRAIGHTLINE CATALOG ILLUSTRATING OTHER TYPES

ACME *Rotary Automatics . . .*

ACME 40" Rotary with 6 station indexing table and 4 ACME Type G-1 lathes with belt arm attachment. One second indexing time . . . up to 1800 indexes per hour. Acme Indexing Rotaries are available in table sizes from 18 in. to 10 ft. diameter.

ACME 10 ft. Combination Rotary . . . for continuous operation using 24 continuously revolving spindles or for 12 station indexing operation using every other spindle. One second indexing time . . . up to 1200 indexes per hour.

ACME 50" Continuous Rotary Automatic with 40 spindles equipped with 4 Acme Type G-3 heavy duty 15 H.P. polishing and buffing lathes with inverted spindles. ACME Continuous Rotaries are available with tables up to 24 ft. diameter.

WRITE FOR ROTARY CATALOG

for POLISHING • BUFFING
GRINDING • MICRO-FINISHING
DE-BURRING • WIRE BRUSHING

SPECIAL MACHINERY — AUTOMATIC BUFFING MACHINES

ACME *Manufacturing Co.*

Builders OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR NEARLY HALF A CENTURY

1400 E. 9 MILE RD., DETROIT 20 (Ferndale) MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 227.

Equipment and Supplies

shooting a specially developed abrasive that is suspended in liquid, in a controlled high pressure spray against a metal surface. The spray produces many minute identical "wells". These tiny pits can be varied in coarseness or fineness, as desired, by using several different grades of abrasive, and changing the spray's length, force, or direction. It can maintain tolerances of precision parts to 0.0001 inch—more than adequate for most industrial processes. For more information on this process, use Reader Service Card.

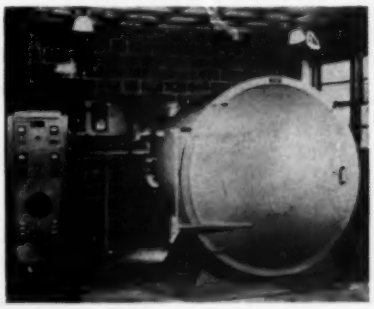
E—217. Agitating Parts Cleaning Machine—A new industrial washing machine, announced by the Cincinnati Cleaning and Finishing Machinery Co., Sharonville, Ohio, features many innovations designed to make cleaning of a wide variety of miscellaneous parts quick and easy. Basically, the machine agitates a tray holding the parts through the cleaning bath, generally a solvent-type material.

An especial advantage of the unit is that it is loaded at normal working level. The operator need not raise or lower parts to be cleaned, and need not get his hands near or into the cleaning solution. No hoist is required. Parts are moved directly from the plant conveyor to the "table-height" tray of the machine, and similarly removed after cleaning.

At the end of the cleaning period (or automatically, if desired), the tray is raised to the loading position again and the clean parts removed onto the plant conveyor. The pneumatic mechanism is the only moving part on the machine; it operates at 100 psi. For more details on this new equipment, use Reader Service Card.

E—218. Single Cartridge Respirator—The first approved chemical single cartridge respirator, Pulmosan's new chemocart C 256, has received United States Bureau of Mines approval No. 2309 for low concentrations of organic vapors. For further information write the Pulmosan Safety Equipment Corporation, 644P Pacific St., Brooklyn, N. Y., or use Reader Service Card.

E—219. New 66-inch Metalizing Unit—Objects which formerly have been uneconomical to metalize because of their large size now can be handled successfully



with a new 66-inch vacuum metalizing unit recently developed by the High Vacuum Equipment Corp., Hingham, Mass.

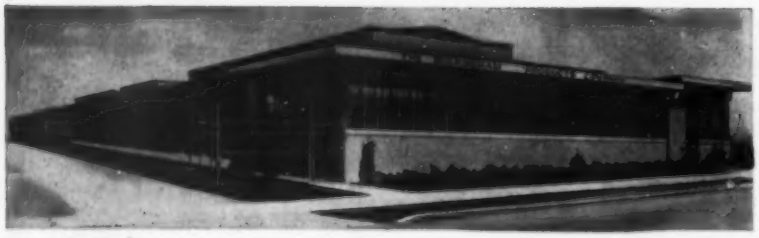
Due to its tremendous capacity plus the rapid cycles obtainable, large objects now can be coated on a mass production basis with superior quality finishes at the lowest possible cost. For more information on this equipment, use Reader Service Card.

E—220. Unichrome Bright Nickel—United Chromium, Inc., 100 E. 42nd St., New York 17P, N. Y., announces that the Unichrome bright nickel process has now been made generally available to the plating industry of the United States. The process, which was developed in the United Chromium laboratories, has been completely tested and field proved in commercial operations. Many thousands of gallons already have been used in a wide variety of industrial nickel plating applications in this country and Canada.

Ease of control, stability, superior receptivity for chromium deposits, and, above all, economy are the major advantages of Unichrome bright nickel as established during its three years of operation. Platers have been most impressed by the stability of the primary brightener over a wide range of *p*H and other operating conditions, this stability resulting in lower, more economical rate of replenish-

Complete, Modern Facilities Assure You The Utmost in Quality and Service on

BUCKINGHAM POLISHING and BUFFING Compositions



- Stainless Steel Composition
- White Finish
- Tripoli
- Chrome Coloring Composition
- Greaseless Composition
- Emery Cake
- Brass Coloring
- Emery Paste
- Burring Compound*
- Grease Stick
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Representation in Major Cities *Write Dep't. B for Samples*

The BUCKINGHAM PRODUCTS Co.

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avoid stream pollution due to chromium waste...

...with W&T Sulphur Dioxide Reduction Equipment

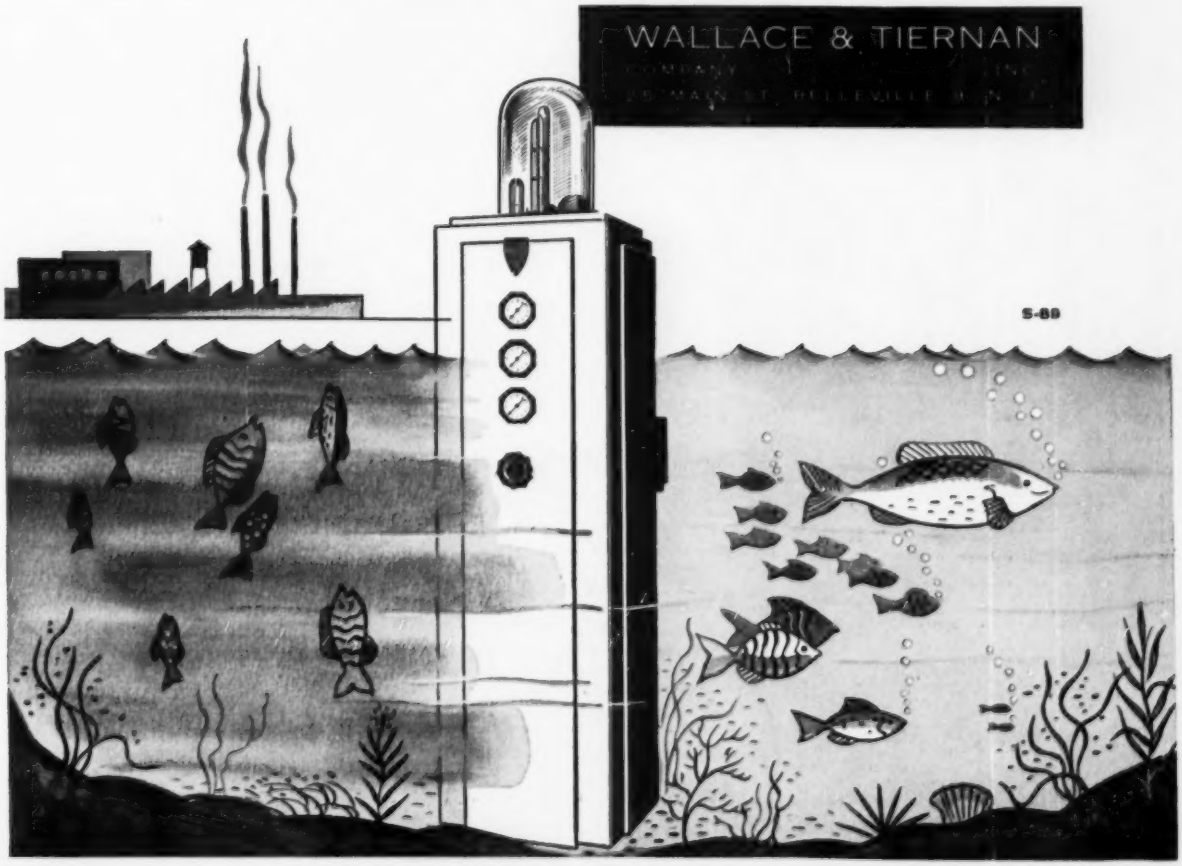
With the proper treatment equipment, toxic hexavalent chromium can be reduced by sulphur dioxide to the trivalent form and then completely precipitated by alkali for standard removal to a disposal area — such as a lagoon. After this treatment the waste water can be drawn off and safely disposed of in the usual manner. This treatment is in full compliance with most local and state pollution abatement laws.

Wallace & Tiernan offers the heat treating and metal finishing industries several types of Sulphur Dioxide Feeders with optional controls for manual, semi-automatic or fully automatic operation. These feeders are adaptable to either the "batch" or "flow-thru" methods of treatment in both large and small plants.

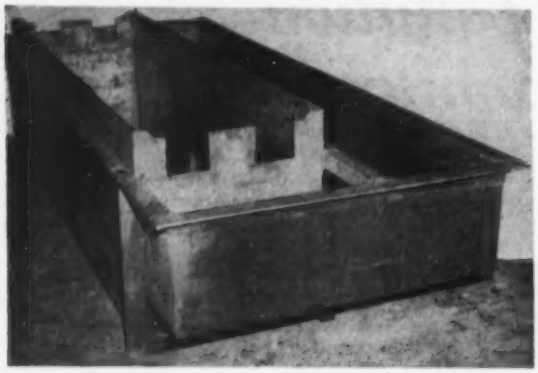
Similar equipment is also available for the destruction of cyanide waste by alkaline chlorination.

W&T offers PROVEN EQUIPMENT — hundreds of similar units are serving industry today, EXPERIENCE — over forty years of building chemical feeding equipment, and SERVICE — field representatives are located in principal cities throughout the country.

Write today for additional information on W&T Sulphur Dioxide Feeders and Alkaline Chlorination Equipment, at no obligation to you, of course.



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 229.



Stortswelded lead lined chrome plating tank

Here is long life performance

STORTSWELDED lead linings add years to tank life and cut corrosion costs. Storts linings are soundly designed and the Storts lead welding specification makes the weld the strongest part of the lining. Consult Storts on all lead work—tanks, coils, exhaust hoods, aprons, etc.—for complete satisfaction.

42 STONE STREET — STORTS WELDING COMPANY INCORPORATED — MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

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CrO_3 Chromic Acid for

DECORATIVE PLATING
HARD CHROMIUM PLATE
ANODIZING ALUMINUM
CHEMICAL CONVERSION COATINGS
STRIPPING COPPER
METAL CLEANING BATHS
ORGANIC SYNTHESIS
MANUFACTURE OF CATALYSTS

The Mutual name and trade mark on a Chromic Acid drum guarantee a product with a minimum assay of 99.75% and a sulfate content not exceeding 0.1%. Chromic Acid of that purity may be used with confidence in any of the applications shown here.

MUTUAL SINCE 1845

MUTUAL CHEMICAL COMPANY OF AMERICA

270 MADISON AVENUE • NEW YORK 16 N. Y.

Equipment and Supplies

ment, also simplification of control.

The Unichrome bright nickel solution has a nickel sulfate, nickel chloride, boric acid composition with special Unichrome addition agents. Most nickel plating solutions having a typical Watts' formulation can be converted to Unichrome bright nickel. For more information on the process, use Reader Service Card.

E—221. Depressed Center Grinding Wheels—The Carborundum Company, Niagara Falls, N. Y., announces the availability of its new Carboflex depressed center grinding wheels for rough grinding, weld removal, cut-off and slotting operations for ferrous and nonferrous metals and nonmetallics.

Combining aggressive cutting action with extreme high strength and resistance to cracking, the new glass-fiber-reinforced resin bond wheels provide efficient operation with maximum safety.

Extensively field tested in foundries, steel mills and all types of metal-working and metal fabricating industries, Carboflex depressed center wheels show all-round versatility.

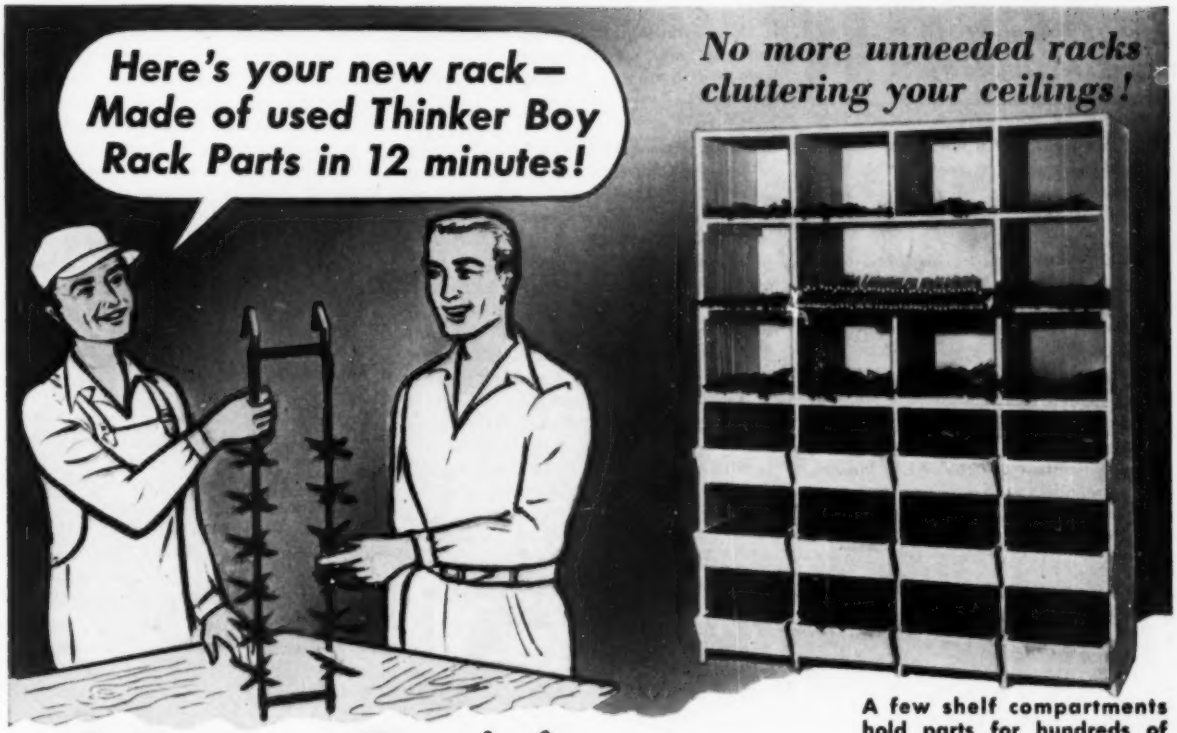
The new wheels come in sizes of 7 and 9⅛ inches in diameter; ⅛, 3/16 and ¼ inch in thickness and contain a 7/8 inch arbor. For more information on these wheels, use Reader Service Card.

E—222. New Resin Cement—The Atlas Mineral Products Co., Mertztown, Pa., announces, that as a result of three years of research, it has developed a resin cement with improved workability which is resistant to all alkalies, detergents, greases, solvents, oils, salts and nonoxidizing acids. This product, which is nontoxic to the applicator, can be applied at a rate approximately 50 per cent faster than any resin cement available previously. For more information on this product, use Reader Service Card.

E—223. Plastic Spray Masks—A plastic putty for making re-usable spray masks has just been developed by the Chemical Development Corp., Danvers, Mass. It is used to protect or mask off metal, plastic and other surfaces during paint-spraying, cementing, flocking, and similar operations.

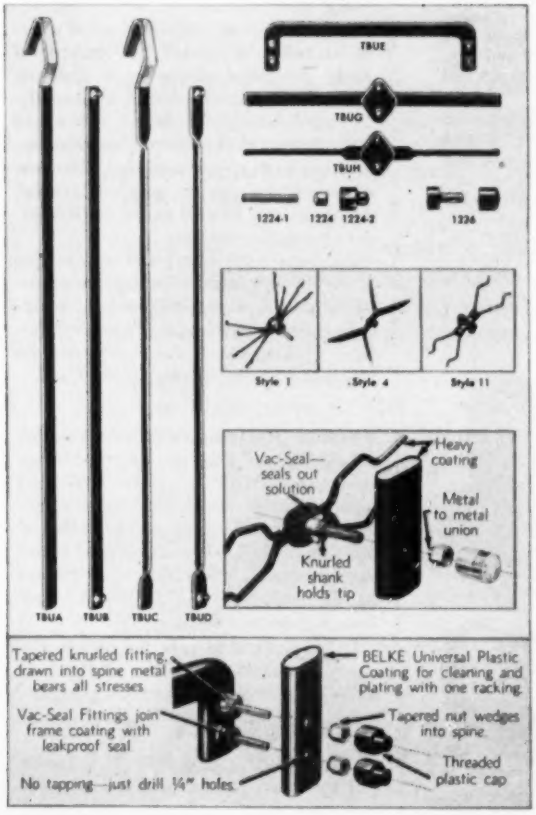
Called CD Spray Mask A, it is supplied as a putty that will harden to an extremely strong, tough and rigid solid 1 to 2 hours after the addition of a catalyst or hardening agent. No heat or pressure is required. It is now possible for any company to make their own spray masks, cementing fixtures, and other

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 231.



It's a Goldmine

A few shelf compartments hold parts for hundreds of Thinker Boy Racks! You use parts of unneeded racks to make new ones—Stop cluttering up ceilings with old worthless racks—cut 80% and more from racking costs.



Efficient, coated, plating racks of your own design—in a matter of minutes—for the mere cost of assembly from used rack parts. Even the tips are coated so nothing else has to be done.

No extra investment necessary. Just get BELKE Thinker Boy Racks when you buy racks (either complete or unassembled). When racks are no longer needed disassemble and store the parts.

Instead of worthless racks cluttering your ceilings, *you soon have a goldmine of coated Thinker Boy Rack Parts.* You can quickly assemble completely coated racks of countless styles and spacings. Only the tip contacts are exposed to plating.

Thinker Boy Parts are mass produced for low cost. A 30" TBUA Spine and Cathode Hook, Universal Plastic coated ready to use is only $2.85.

For information *about the greatest time and money saving rack development in all plating history,* ask your BELKE Service Engineer or write.

Belke MANUFACTURING CO.
947 N. Cicero Ave.
Chicago 51, Ill
EVERYTHING FOR PLATING PLANTS

Equipment and Supplies

parts in a matter of a few hours, and at a fraction of previous costs. For more information on this product, use Reader Service Card.

E—224. New Immersion Tin—The Enequist Chemical Co., Inc., 100 Varick Ave., Brooklyn 37P, N. Y., announces commercial availability of a fast depositing, white color, immersion tin process.

For those who require a corrosion resistant coating by a fast method without the use of current, this process answers a long sought need. It is operated at room temperature (75°–85° F) in plastic, glass or stainless steel tanks or crocks.

A uniform deposit is obtained in 2 to 3 minutes, with mild agitation. For more information on the process, use Reader Service Card.

E—225. New Wet Burnishing Process—Gerity-Michigan Corporation, Adrian, Mich., have announced a revolutionary and completely new method of wet burnishing designed to improve conventional polishing and buffing procedures. The new method provides important savings through the use of revolving rubber mats which operate in a wet abrasive slurry. The parts to be burnished are advanced through the slurry on a carrier moving in a circular or other enclosure.

The company stated that fabric polishing and buffing wheels last about five to fifteen per cent as long as the rubber fingered mats used on the new Ger-O Matic machines which provide important savings in buff costs. Compounds in the abrasive slurry are re-used over and over with little loss. As this is not possible with conventional polishing and buffing compounds the new method further cuts costs through savings in compounds. There is a complete absence of dust thus reducing fire and health hazards and making elaborate exhaust systems unnecessary. For more information on this new process, use Reader Service Card.

E—226. Plastic-Enclosed Thermostat—A special series of Thermoswitch thermostats, completely enclosed in a plastic sleeve, has been developed for severe humidity and corrosion service by Fenwal Incorporated, Ashland, Mass.

The plastic-enclosed Thermoswitch unit may be immersed in most strong and weak acids, alkalis, and salts without ill effect. As a result, it can be used for temperature control or overheat detection for such applications as plating baths, pickling baths, humidity and corrosion testing chambers. For more information on this product, use Reader Service Card.

E—227. Material Permits Cold Metalizing with Aluminum—The perfection of a new material which made it possible to metalize surfaces with aluminum, without the use of heat, was announced today by Emjay Maintenance Engineers, 327P Union Ave., Rutherford, N. J. The process is based on the development of a material called Kolmetal®, a mixture of finely pulverized aluminum in a plastic base. The resultant coating, achieved by two applications of Kolmetal with a four hour drying time between applications, air hardens to a plastic bonded aluminum surface which can be polished, ground, drilled or bent to a 45 degree angle without chipping or cracking.

Exhaustive laboratory and service tests made by independent testing companies reveal that Kolmetal has excellent resistance to atmospheric and sea water corrosion. Full details on the process may be obtained by using Reader Service Card.

E—228. Replacement Cylinders for All Makes of Plating Barrel Superstructures—With the claim that "old superstructures never die," a complete line of replacement plating cylinders of "H-T Sincolite" to fit all makes of barrel superstructures, old and new, is offered by the Singleton Co., 5317P St. Clair Ave., Cleveland, Ohio.

It is expected to save for platers the many thousands of dollars invested in their old and obsolete barrel superstructures which otherwise would be a total loss.

Singleton "H-T Sincolite" (H-T Lucite and Plexiglas) plating cylinders are said to be the only complete line engineered

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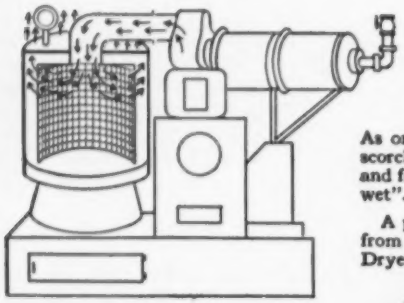

If you did, you saw a practical demonstration of the principle of air deflection. In old type dryers, air *blown* in from the top is deflected by the top layer of parts. As one user put it, "the top layer gets scorched, the next layer is nice and dry, and from there on down the parts are still wet".

A powerful suction fan *draws* the air from the bottom of the modern Nobles Dryer. Fresh air rushes in from the top to fill the vacuum and is drawn through the entire contents from top to bottom where it is expelled with the water.

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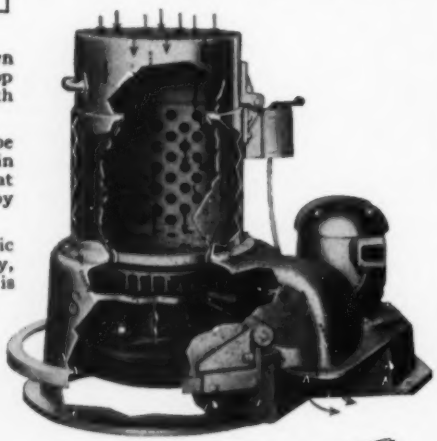

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For full details about Ahcoloid Emulsion Cleaner write today for Bulletin B-9 to Apothecaries Hall Co., 22 Benedict St., Waterbury, Conn.

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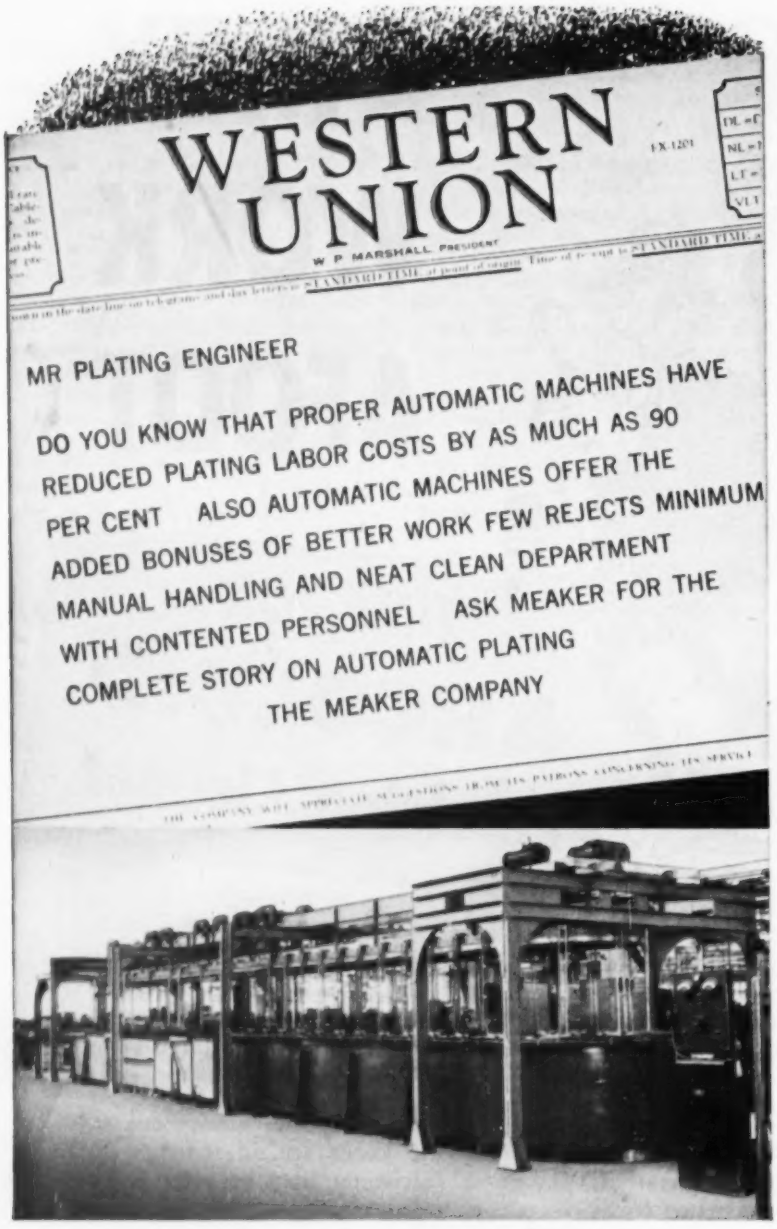
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E—229. New "Karbate" Impervious Graphite Centrifugal Pumps—A new series of "Karbate" impervious graphite centrifugal pump sizes and types has been announced by National Carbon Co., a Division of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17P, N. Y.

The new pumps, through an array of design improvements on the original Model A pump, offer the chemical industry two distinct new "Karbate" impervious graphite pumps for application not only for those severe corrosive conditions for which they already are quite noted, but also wherever pumping conditions are corrosive to ordinary iron and steel and such common applications as the handling of salt brines and sea water. They are easier to install, easier to operate, easier to maintain, and they cover a greatly extended range of capacities. For more information on these new pumps, use Reader Service Card.

E—230. Fiberglas Plating Tanks—A new line of corrosion resistant Fiberglas plating tanks has been announced by the L. A. Darling Company of Coldwater, Mich.

Substantial savings in maintenance, production and replacement costs are possible because the new tanks are highly resistant to normal concentrations of common plating acids. In addition, some electroplating troubles are reduced by the nonconductivity of the tanks. Forty-one standard tanks and other special tanks provide sizes and shapes for practically every plating requirement.

Construction is of polyester-resin bonded Fiberglas. All standard tanks are built with straight sides of uniform thickness, square corners and bonded joints. Steel reinforcing ribs and extra wall thickness are used to maintain maximum strength dependent upon tank size. For complete information, use Reader Service Card.

E—231. Pencil Grinder—Added safety has been built into the newest pencil grinder made by Nu-Jett Products, 1355P Michigan N. E., Grand Rapids, Mich.

The newest model has a safety guard which fully encloses the chuck nut, makes finger burns impossible and gives even more accurate control. For more information on this smallest and lightest grinder on the market, use Reader Service Card.

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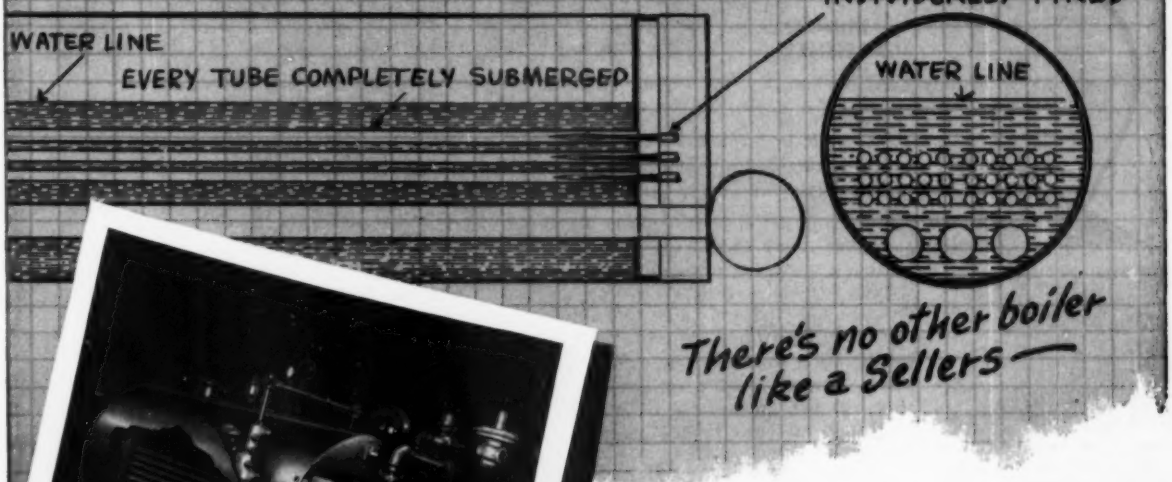

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the average flue gas travel is 15 feet!

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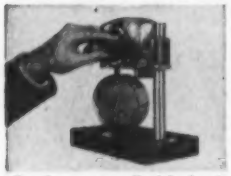

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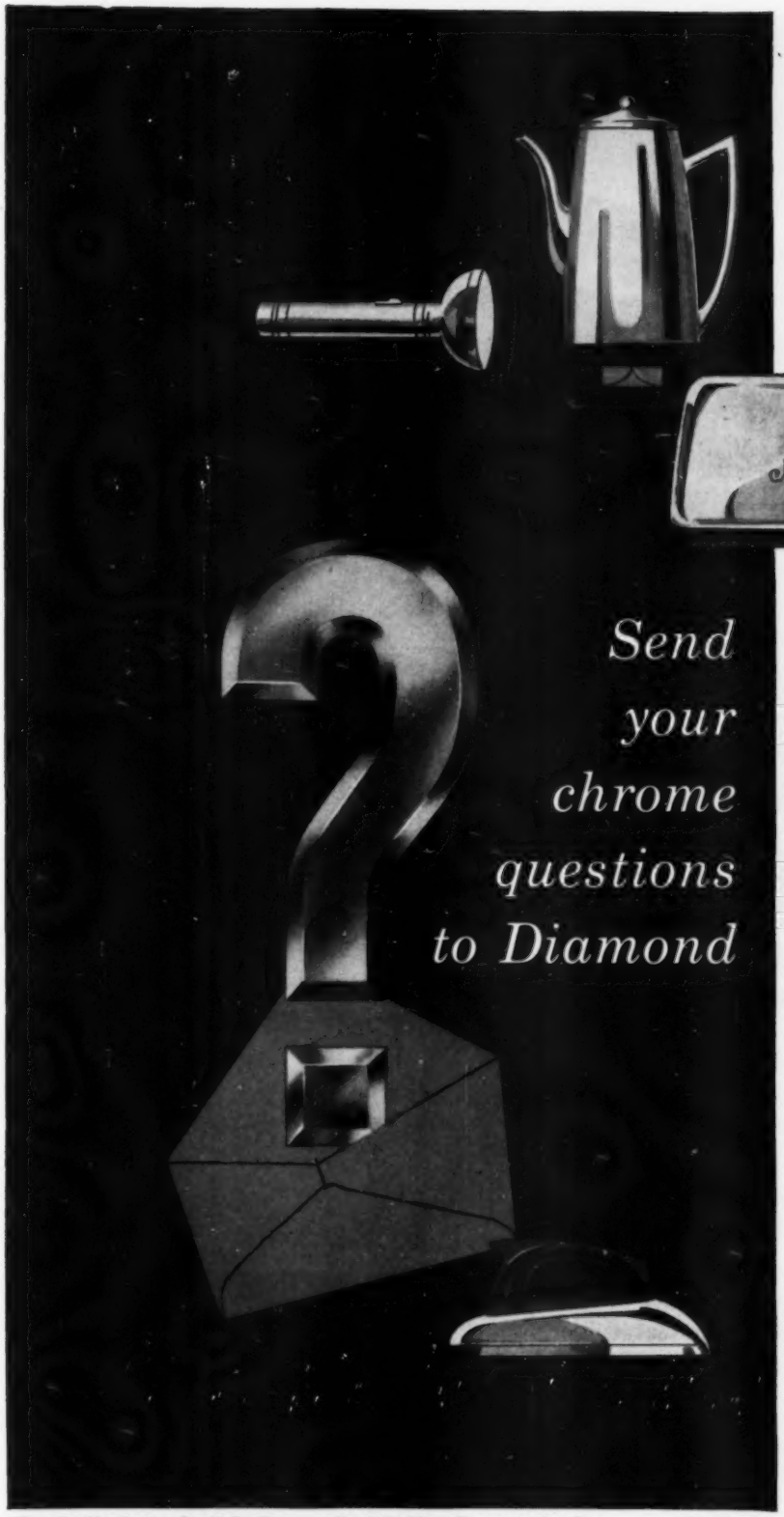

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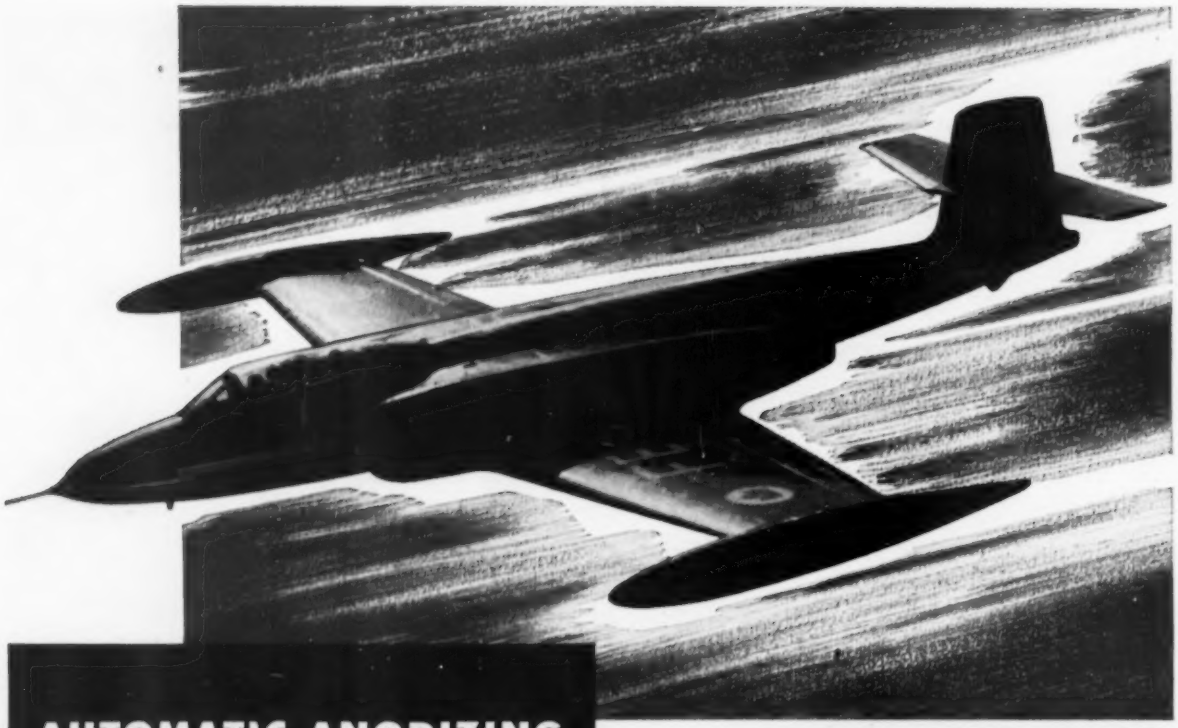

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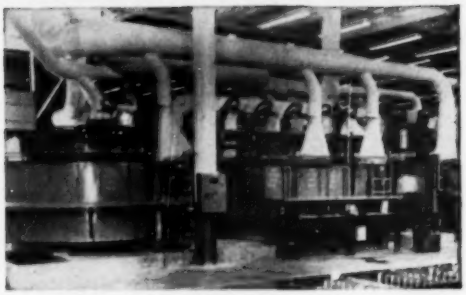

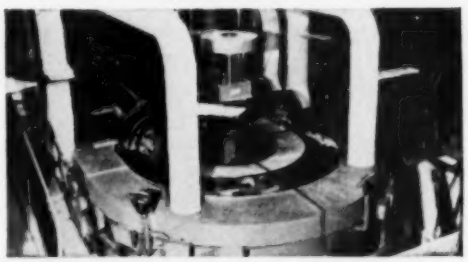

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FEBRUARY, 1954 VOL. 41, No. 2

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Editorial

The AES Interim Meeting — Blueprint For a Convention . . .

FEBRUARY 13 marks the third Interim Meeting to be sponsored by the Society. This year's session follows those held in Philadelphia and Columbus, Ohio, and features reports, proposals and all matters referred to the Supreme Society by the Annual Meeting. Climaxing the one-day meeting, which starts at 10 a.m., will be nominations for National Third Vice-President, a post which this year should be hotly contested, according to reports.

Here again the spotlight is on the Branch Delegate. His important role in Society affairs is re-emphasized. It is a time when the Branch through him is given the opportunity to voice its sentiments for or against a proposal . . . a time when he and other Delegates get together to plan the forthcoming National Convention.

Host to the many Delegates and members will be the Toronto Branch. An enjoyable visit is promised and Toronto members extend an invitation to all who may wish to attend the local Branch's Annual Meeting on February 12 at the Royal York Hotel, setting, also, for the Interim Meeting the following day.

The AES Interim Meeting is another "must" for Delegates. The confusion of convention planning, the plethora of detail can be well minimized if Delegates attend and take active part in this important session, truly a blueprint for July's convention in New York City.

P. Peter Kovatis

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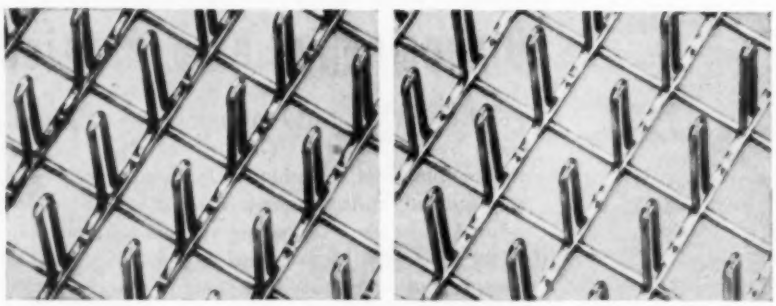

(Left): Photograph of dish drainer basket plated in ordinary chromium solution. Dark areas at base of wire fingers show no coverage of nickel.

(Right): Same product when plated in SRHS Chromium Solution. Note the even color at top and base of finger – evidence of complete coverage.

MORE than 700 commercial installations of the Unichrome SRHS Chromium Solution are now in operation. These have provided working demonstrations that ordinary chromium solutions, unchanged since development in 1925, are virtually obsolete.

Briefly, the striking improvements stem from several important characteristics of the SRHS bath. Namely, its higher cathode efficiencies; its self-regulation of important chemical constituents which helps maintain optimum plating balance; and its wider bright plate range. These have benefited platers in various ways. For example:

20% to 80% FASTER PLATING

With an SRHS Solution, one plater was able to speed up an automatic machine. Plating work in 2 minutes 25 seconds instead of 3 minutes 38 seconds, he not only increased the machine's capacity 33% but also improved quality by exceeding thickness specifications.

Another company needed additional tanks to handle increased production of plated cutlery. Just by using the SRHS Solution, existing capacity was stepped up and the expense of new equipment saved.

BETTER COVERAGE

Photographs above show wire baskets used in dishwashers. Ordinary chromium couldn't cover this complicated shape but the SRHS Solution plated the work completely.

The solution has wider bright plate range. SRHS Chromium, therefore, not only means less "missing" but also less "burning." Consequently, it assures fewer rejects.

MORE WORK WITH LESS CURRENT

Finishing automobile bumpers, one company could plate only 8 on a rack in the ordinary solution. Requiring less current, SRHS Chromium permitted plating 9 bumpers per rack – or an 11% increase in production with no change in equipment.

A plant plating cigarette lighters in the ordinary solution was behind schedule due to limited current. Switching to SRHS Chromium, they found it possible to plate the same work load with ⅓ less current and in ½ the time.

SELF REGULATION SIMPLIFIES PROCEDURE

A printing company installed an SRHS Solution for chromium plating rotogravure cylinders. They had no previous chromium plating experience. Despite this lack, the SRHS Bath enabled them to plate 2800 cylinders with only 5 rejects.

★ ★ ★

With results like these, it no longer pays to work with a chromium solution of the "1925 vintage." Learn how to convert your plating operation without disrupting production. Detailed technical information available. Or call in a United Chromium engineer for complete facts.

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What to look for in chromium plating anodes

Quality of chromium plating anodes can be gauged by several important factors.

First is composition of the anode. If it's tin-lead alloy, it better resists corrosive action of chromic acid during both idle and active periods.

Then check the bond between body and copper hooks. Best conductivity results when hooks are tinned, alloy cast to the hook, and anode body then fused on.

Finally, observe the hook. Does it assure good contact with a knife-edge wedge-type hook that cuts through encrustations on anode bars?

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RADIOMETRIC STUDY OF SUPPLEMENTARY CHROMATE COATINGS FOR ZINC AND CADMIUM PLATING*

STANLEY L. EISLER, JODIE DOSS AND MARY ANN HENDERSON†

Abstract

Radiosulfur and radiochromium were used to determine the amounts of sulfate and chromium contained in coatings produced from various supplementary dip solutions. The leaching of these two ions during exposure was also determined. It was found that the amount of sulfate and chromium in the coating increases as the concentration of H_2SO_4 in the dip solution is increased, although not proportionately. The loss of chromate during exposure was very slow and did not exceed 10 per cent after extended exposure periods. However, the sulfate was lost more rapidly, with the greatest loss in the first week and continuing up to as high as 70 per cent after several weeks' exposure.

Introduction

Chromate supplementary coatings came into prominence during the last World War due to the need for improving the corrosion resistance of cadmium and zinc plated objects. The original solutions consisted of chromate salts and either sulfuric acid or nitric acid. At present, a large number of commercial preparations use one or more of the following materials in addition to one of the above named acids and chromate salts: formic acid, soluble formate salts, ferric chloride, silver nitrate, acetic acid, sodium chloride, trifluoroacetic acid and zinc nitrate.

Chromate supplementary coatings are believed to be gelatinous films formed on the surface of metallic zinc or cadmium by the chemical reaction of the chromate solution with the metal during a short immersion period. The color of these thin coatings may be olive drab, bronze, yellow iridescent, blue bright, or clear bright. In addition, many of these coatings may be dyed black, red, blue or green.[1] The coatings are believed to be approximately 0.02 mil thick.[2] An analysis of the coating on zinc reveals that it is composed of chromium, traces of zinc and other occluded constituents of the acid chromate bath.[3] Maxon[4] states that the chromate supplementary coating is composed of approximately 28 per cent trivalent chromium and 8 per cent hexavalent chromium. Anderson[5] believes the coating to be a colloidal film of the basic chromium chromate of the general formula $Cr_2O_3 . CrO_3 . XH_2O$ and that the inhibitory property is due to the hydrolysis of this film in the presence of moisture and the release of the soluble hexavalent chromium which prevents rapid corrosion of the metal. The trivalent chromium is also believed to offer protection of the metal by exclusion of water from the surface.

It had been observed that some supplementary chromate coatings on zinc and cadmium plated articles processed in a chromate-sulfuric acid bath showed corrosion products and pitting after storage in a damp area. However, coatings produced by treatment in a chromate-nitric acid bath showed no signs of corrosion, indicating that the failure of the first coating may have been due to free sulfate occluded in the supplementary chromate coating.

This investigation was undertaken to prove or disprove the effect of occluded SO_4^{--} in the coating provided the presence of the occluded SO_4^{--} in the coating could first be established. The use of radiometric techniques for this investigation was chosen since the amounts of chromate or sulfate are extremely small and other means of measurement would prove inadequate.

Materials Employed

Six supplementary chromate dip solutions were prepared. Each solution contained 200 g/l of $Na_2Cr_2O_7$ and varying amounts of H_2SO_4. Solutions were numbered 1 through 6 and contained 4, 5, 6, 7, 8 and 9 ml of H_2SO_4 per liter, respectively.

The radiosulfur as $H_2S^{35}O_4$ and radiochromium as

*The opinions or assertions contained herein are not to be construed as being official or reflecting the views of the Department of the Army.

†Ordnance Corps, Rock Island Arsenal, Rock Island, Ill.

TABLE I. COUNTING DETERMINATIONS, CONTROL COUPONS

Solutions	Average Net C/M S^{35}	Specific Activity C/M/g SO_4 x 10^{-6}	Average Net C/M Cr^{51}	Specific Activity C/M/g Cr x 10^{-6}
1	392	5.61	1645	4.15
2	393	4.50	1588	4.01
3	407	3.88	1629	4.11
4	409	3.34	1618	4.09
5	398	2.85	1607	4.06
6	367	2.33	1519	3.84
A			592	2.87
B			594	1.61

$Cr^{51}Cl_3$ were purchased from the Oak Ridge National Laboratory by authorization of the U. S. Atomic Energy Commission, Isotopes Division. The $Cr^{51}Cl_3$ was oxidized to the hexavalent state by treatment with NaOH and H_2O_2. Sufficient amounts of the two tracers were added to each of the six solutions to provide an activity level of approximately 0.2 microcurie of S^{35} and 20.0 microcuries of Cr^{51} per ml of solution.

Two commercial supplementary dip compounds, designated compounds A and B, were made up according to the manufacturers' specifications for comparison in the leaching test only. Subsequently, identical solutions of A and B were prepared with radiochromium added to provide an activity level of approximately 20.0 microcuries per milliliter. The radiosulfur was omitted from these solutions since HNO_3 is used as the main constituent other than the chromate salt. The latter two solutions were used for tests A-7 through A-10 which will be mentioned later.

The coupons used in this investigation were circular discs made of SAE 1020 steel, 0.975 inch in diameter, and 1/16 inch thick. A 0.073 inch hole was drilled 1/16 inch from the edge for ease of handling with Monel wire hooks.

The coupons were degreased in a trichloroethylene vapor degreaser for five minutes and electrolytically cleaned in an alkaline derusting bath. After a cold water rinse, half of the coupons were plated in a bright cadmium bath at room temperature using a current density of 20 amps/sq ft. The remaining coupons were plated in a bright zinc bath at room temperature using a current density of 30 amps/sq ft. Forty coupons without holes were cleaned and degreased in the same manner and cadmium plated for use as controls. A plated thickness of approximately 0.2 mil was obtained in all cases. The coupons were rinsed thoroughly after plating and air blown until dry.

Coating Procedure

A small portion of each of the test solutions was set aside, for use in control coupon preparation, prior to coating the large number of test coupons.

The coupons were individually immersed for 15 seconds in the supplementary chromate dip solutions within 30 minutes after plating. After removal from the solutions, each coupon was rinsed in running tap water and air blown until dry.

Counting Procedure

The coupons were counted by placing the test coupon in the center of an aluminum slide held in a Lucite mount so that the surface of the coupon was approximately 5 millimeters from the mica window of a Geiger-Müller tube operated in conjunction with a scaling unit. The Lucite mount was enclosed in a 1½ inch lead shield to reduce the background count due to cosmic radiation and other sources. Each coupon was counted for a 3 minute period and the counting rate corrected for background, coincidence loss and decay.

Radiometric determinations of radiochromium were carried out by use of an argon-filled TGC-3 Geiger-Müller tube. A beryllium absorber with a thickness of 150 mg/sq cm was employed with this tube to cut out all beta emissions from the radiosulfur. The absorber also prevents approximately 50 per cent of the low energy X-rays of the radiochromium from reaching the sensitive portion of the tube but this was not considered disadvantageous.

A helium-filled TGC-2 Geiger-Müller tube was used for measuring the radiosulfur in the presence of radiochromium. This was possible because this tube has a very low efficiency for detection of the soft X-rays emitted by the radiochromium. Through the use of these two tubes, it was possible to count the radiations emitted by each isotope in the presence of the other.

Preparation of Controls

Five cadmium plated control coupons for each tracer containing solution were prepared by pipetting 1 milliliter of a 1-100 dilution of the original supplementary dip solution onto the surface of the coupon.

The five control coupons were placed on the table of a sample spinner which was operated at 20 rpm and

TABLE II. COUNTING DETERMINATIONS, TEST COUPONS

Solutions	Test A-1	Test A-2	Test A-3	Test A-4	Test A-5	Test A-6
	Average Net Counts/minute of Cr^{51}					
1	316	247	236	247	251	268
2	353	297	353	395	418	324
3	496	419	435	509	494	427
4	605	497	546	593	629	496
5	627	505	562	635	681	530
6	672	587	621	704	718	613
	Average Net Counts/minute of S^{35}					
1	127	114	98	87	85	85
2	141	121	116	119	119	100
3	175	154	154	155	137	128
4	207	183	170	177	185	142
5	212	166	160	177	178	153
6	206	171	167	192	178	156

the solution pipetted onto the coupons. The solution was evaporated to dryness under an infrared lamp as the table rotated in a slightly inclined position. This method of allowing the solution to be washed repeatedly over the coupon surface was employed to produce a more even distribution of the solution residue.

The average counting rates of the control coupons and the specific activity for each solution are presented in Table I. The specific activity (counts per minute per gram) was calculated for the Cr and SO_4 in each solution by dividing the average counting rate of the control coupons by the amount of Cr or SO_4 contained in the aliquot portion pipetted onto each control coupon. The amounts of Cr contained in solutions A and B were determined by analysis and were found to be 20.7 and 37.0 g/l, respectively.

Effect of Sulfate Concentration

Three sets of zinc plated and three sets of cadmium plated coupons were employed for this series of tests. The three tests of zinc plated coupons are designated tests A-2, A-3 and A-6 while the cadmium tests are designated tests A-1, A-4 and A-5. Each test included thirty coupons, five treated in each of the six supplementary dip solutions.

The average net counting rates for the six tests are presented in Table II. It will be noted that separate values have been obtained for the S^{35} and Cr^{51} radioisotopes by use of the two types of Geiger-Müller tubes previously described.

Utilizing the counting rates of the test coupons and the specific activities of the various solutions (cf. Table I) it was possible to calculate the weight per square foot of SO_4^{--} or Cr on the test coupons as follows:

$$\text{Weight on test coupon} = \frac{\text{Counting Rate of test coupons}}{\text{Specific activity of solution}}$$

Weight on test coupon x 192.8 = grams/sq ft
(192.8 is the conversion factor for converting the coupon area to a square foot)

The weights of sulfate and chromium expressed as grams per square foot obtained under the various test conditions are presented in Tables III and IV, respectively. Examination of these two tables reveals the following facts:

1. The amount of sulfate in the coating increased as the concentration of H_2SO_4 in the solution was increased, although not proportionately.

2. It may be noted from the values presented that the differences between solutions 1 and 2, 2 and 3, etc., become greater in nearly every case, with the exception of the difference between 4 and 5, as the H_2SO_4 concentration is increased. A possible explanation of this variation in behavior may be that as the concentration of H_2SO_4 in the solution is increased a desorption reaction begins and becomes competitive with the adsorption reaction. Therefore, at the concentration of solution No. 5 this second reaction attains its maximum, causing a decrease in the amount of sulfate expected in the coating.

3. The amount of chromium in the coating also increased as the amount of H_2SO_4 in the solution was increased, although not proportionately.

4. The chromium results also indicate the same drop-off in adsorption at the level of solution No. 5 as noted for the sulfate in the coating.

5. In all cases, the amounts of sulfate and chromium deposited on the cadmium plated coupons was

TABLE III. WEIGHT OF SULFATE IN SUPPLEMENTARY COATINGS

Solutions	Grams/sq ft x 10^3			
	Test A-1	Test A-4	Test A-5	Average
1	4.36	2.99	2.91	3.42
2	6.03	5.09	5.09	5.40
3	8.71	7.71	6.80	7.74
4	11.93	10.20	10.66	10.93
5	14.34	11.97	12.05	12.79
6	17.04	19.60	14.73	17.12
Zinc Plated Coupons				
	Grams/sq ft x 10^3			
	Test A-2	Test A-3	Test A-6	Average
1	3.91	3.35	2.91	3.39
2	5.19	4.97	4.28	4.81
3	7.65	7.65	6.36	7.22
4	10.54	9.79	8.19	9.51
5	11.24	10.83	10.35	10.81
6	14.15	13.80	12.90	13.62

greater than that deposited on similarly treated zinc plated coupons. This may be attributable, at least in part, to the lower solubility of cadmium salts as compared to zinc salts.

6. It may be noted that generally there was a drop in the amount of sulfate in the coatings prepared from the same solutions in later tests. This was due to a slight depletion of the H_2SO_4 in the supplementary dip solutions. This was not noted with chromium, no doubt, because of the greater concentration of $Na_2Cr_2O_7$ in the solution.

The results of these tests, presented above, indicate that the sulfate in the supplementary dip solution becomes an integral part of the coating, which was the primary question to be answered by this investigation. There also appears to be evidence that the colloidal film mentioned by Anderson[9] as consisting of $Cr_2O_3 . CrO_3 . XH_2O$ may have a more complex formula containing the sulfate ion or a complex sulfate salt. However, there is also the possibility that some, if not all, of the sulfate may be held in the film merely by occlusion. Evidence to be presented in a later section dealing with leaching tests performed on the various coatings seems to substantiate the latter hypothesis.

Evaluation of Nitrate Containing Solutions

Duplicate runs of cadmium plated coupons (tests A-7 and A-8) and zinc plated coupons (tests A-9 and A-10) were used for this phase of the investigation. Each test included ten coupons, five processed in solution A and five in solution B. Both solutions contained Cr^{51} as the tracer.

The average net counting rates based on Cr^{51} determinations are presented in Table V as are the weights of chromium per square foot calculated from the counting rates and the specific activities (cf Table I).

Comparison of the results for the amount of chromium contained in the coating reveals the following:

1. Coatings produced from compound A contained one and one-half times more chromium than coatings produced from compound B.

2. Both compounds produce approximately 60 per cent more chromium in the coating on cadmium plate than they do on zinc plate.

3. Both nitrate containing compounds produced coatings having a chromium content from 2 to 4 times that found in coatings produced from sulfate containing baths. This may, of course, be attributed to the presence of buffering agents, wetting agents, or metallic additives, which may be included in the two commercial products.

Leaching Studies

This series of tests was conducted to endeavor to determine the following:

1. The rate of dissolution of the chromium and sulfate from the coating under various exposure conditions.

2. The effect of the sulfate in the coating on the corrosion resistance.

3. The corrosion resistance of coatings prepared from nitrate containing dip solutions as compared to those prepared from sulfate containing solutions.

The first phase of this series of tests involved a cold

TABLE IV. WEIGHT OF CHROMIUM IN SUPPLEMENTARY COATINGS

Solutions	Grams/sq ft x 10^3			
	Test A-1	Test A-4	Test A-5	Average
1	14.7	11.5	11.7	12.6
2	16.9	19.0	21.0	18.7
3	23.2	23.8	23.1	23.4
4	28.6	28.1	29.7	28.8
5	31.0	30.1	32.3	31.1
6	33.8	35.4	36.1	35.1

Zinc Plated Coupons

	Grams/sq ft x 10^3			
	Test A-2	Test A-3	Test A-6	Average
1	11.5	11.0	12.5	11.7
2	14.3	16.9	15.6	15.6
3	19.6	20.4	20.0	20.0
4	23.5	25.8	23.4	24.2
5	23.9	26.7	25.1	25.2
6	29.5	31.2	30.8	30.5

water immersion test of the coupons prepared for tests A-1 and A-2 previously mentioned. These coupons, control coupons (with no supplementary dip) and coupons processed in compounds A and B (without tracer) were suspended 2 to 3 inches below the surface of the water from Monel wire hooks in a rectangular copper tank through which tap water (approx. 19° C) flowed continually. Both cadmium plated and zinc plated coupons were processed in the compound A and B solutions.

The second phase of this series of tests involved the exposure of similar groups of coupons in the Rock Island Arsenal type humidity cabinet. This test was conducted as it was thought that the 95–100 per cent relative humidity maintained at a temperature of 100° F would provide a more corrosive atmosphere so that results could be obtained in a much shorter time. This phase included the coupons of tests A-3, 4, 5, 6, 7, 8, 9 and 10 previously mentioned with controls and coupons processed in compounds A and B containing no radiochromium.

The coupons exposed in the two environments were removed periodically to be counted, as previously noted, to determine the amount of chromium or sulfate lost from the coating during the exposure period. After correction of the counting rates for decay, the per cent of residual sulfate or chromium on the coupons was determined by dividing the original counting rate by the corrected final counting rate and multiplying by 100.

The percentages of residual chromium for test A-1 are presented in Table VI along with the percentages of residual sulfate for tests A-1 and A-2, the two tests conducted in the cold water. The results for per cent residual chromium for test A-1 are the only chromium results presented as in all other tests it was found that

TABLE V. EVALUATION OF NITRATE CONTAINING SOLUTIONS

Solutions		Average Net Counts/minute of Cr^{51}		
	Test A-7	Test A-8	Test A-9	Test A-10
A	1448	1576	978	787
B	564	523	346	369

Solutions		Chromium in grams/sq ft x 10^3		
	Test A-7	Test A-8	Test A-9	Test A-10
A	97.7	106.4	65.9	53.0
B	67.7	62.8	41.6	44.3

TABLE VI. COLD WATER LEACHING TEST RESULTS

Test A-1 Cadmium Plated Coupons
Per Cent Residual Chromium After Exposure

Solution	1 week	2 weeks	4 weeks	5 weeks	6 weeks
1	86.1	92.4	80.1	88.9	86.4
2	92.1	96.3	93.2	80.5	75.9
3	85.9	93.5	70.2	65.9	62.3
4	89.4	85.1	77.4	77.4	75.4
5	87.6	85.0	77.7	74.6	73.5
6	83.0	78.4	64.4	67.3	61.8

Test A-1 Cadmium Plated Coupons
Per Cent Residual Sulfate After Exposure

Solution	1 week	2 weeks	4 weeks	5 weeks	6 weeks
1	79.5	67.6	63.0	59.8	60.6
2	78.0	70.9	67.4	56.7	56.7
3	80.0	82.3	57.7	57.1	52.6
4	81.2	80.7	59.9	54.6	53.0
5	83.0	82.5	61.8	61.3	55.7
6	75.7	65.5	55.3	51.5	48.5

Test A-2 Zinc Plated Coupons
Per Cent Residual Sulfate After Exposure

Solution	1 week	2 weeks	4 weeks	5 weeks	6 weeks
1	74.5	77.2	75.4	64.0	64.9
2	83.5	83.5	74.4	71.1	66.1
3	90.3	90.9	76.6	72.7	73.4
4	85.8	77.0	79.2	72.7	64.5
5	97.0	87.3	83.7	83.1	74.1
6	90.6	93.0	88.9	75.4	76.6

TABLE VII. HUMIDITY CABINET LEACHING TEST RESULTS

Test A-3 and A-6 Zinc Plated Coupons
Per Cent Residual Sulfate After Exposure

Solutions	1 week	2 weeks	3 weeks	4 weeks	5 weeks	6 weeks
1	37.7	28.9	30.7	32.4	34.4	33.1
2	44.0	36.7	33.8	30.1	28.1	30.9
3	49.2	40.6	34.1	37.1	32.8	38.4
4	42.5	42.0	36.9	38.3	33.2	32.1
5	48.7	46.1	38.5	38.9	33.5	42.3
6	40.6	39.1	35.6	33.4	31.5	30.9

Test A-4 and A-5 Cadmium Plated Coupons
Per Cent Residual Sulfate After Exposure

Solutions	1 week	2 weeks	3 weeks	4 weeks	5 weeks	6 weeks
1	60.1	59.2	57.1	58.3	53.5	39.1
2	63.9	57.1	55.4	59.7	49.6	49.6
3	68.2	62.5	63.8	65.0	54.8	53.3
4	63.6	55.9	49.7	50.8	48.4	47.3
5	54.6	48.7	44.2	47.9	41.4	43.6
6	53.2	46.7	48.1	41.8	36.3	41.2

the amount of chromium lost from the coupons, even after an extended exposure period, was less than 10 per cent. Table VII contains the per cent residual sulfate results for the humidity cabinet tests. The results of similar tests are presented as an average of the two tests.

The following salient points may be noted from the data presented in Tables VI and VII:

1. The per cent of residual chromium on supplementary chromate dipped cadmium plated coupons after six weeks' exposure was found to be independent of the total amount of chromium on the specimens prior to exposure. This would seem to indicate that the chromium is all in the same form although larger amounts are deposited on the coupons from solutions of higher H_2SO_4 concentration.

2. All tests indicated that the largest percentage of either chromium or sulfate was lost during the first week of exposure. This leads to the assumption that the original quantities of either ion leached from the surface are present in the coating merely as occlusions and not as true components of the coatings.

3. In the cold water test environment the sulfate was leached from the cadmium plated coupons to a greater extent than from the zinc plated coupons. However, the reverse was true for the tests conducted in the humidity cabinet. Based upon the relative solubilities of the two metallic sulfates, the latter condition would be expected, if it can be assumed that the metallic sulfates are actually formed and are a constituent of the coating. Another possible reason for this reversal may have been due to the speed of reaction since only about half as much sulfate was removed from the coating after a six-week exposure in the cold water as compared to a similar humidity cabinet exposure.

4. Comparing the amount of sulfate leached from the coating under the two test environments employed, it may be noted that in every case a much greater amount of sulfate was lost during the humidity cabinet exposure.

5. The amount of sulfate retained in the coating was found to be independent of the amount of H_2SO_4 in the supplementary dip solution.

Corrosion Resistance

Inspection of the various test coupons used for the leaching tests at the end of each exposure period was made to determine the time at which red rust was first visible. The evaluation of the above was found to be extremely difficult in the case of zinc plated coupons due to the formation of heavy zinc salt deposits. A statistical comparison was further complicated by the fact that generally there were very wide discrepancies between the times of failure of coupons within the same group.

The following general statements may be made concerning the results of the corrosion resistance tests:

1. The corrosion resistance of all treated coupons was greater in the humidity cabinet tests than in the circulating water tests. This was contrary to the expectation previously mentioned. This contradiction may have been due to the continuous washing action of the circulating water.

2. It was also found that very little advantage was provided by the use of the supplementary coatings when the coupons were exposed in the circulating water. This, of course, is a severe condition which ordinarily would not be encountered in service.

3. In all of the humidity cabinet tests it was found that the supplementary coatings provided about the same amount of additional protection. This was true of the sulfate containing baths as well as the nitrate containing baths. It was also found that the amount of H_2SO_4 in the sulfate baths had no effect on the corrosion resistance of the coating.

4. The supplementary dip coatings were found to increase the corrosion resistance of the cadmium plated coupons to a greater extent than that of the zinc plated coupons.

Summary

Although it was proved that the coatings prepared from sulfate containing solutions contained sulfate, no definite relationship could be determined as to the effect of the sulfate on the corrosion resistance of the coating. The fact that the sulfate is leached from the coating to a considerable extent prior to the beginning of corrosion may indicate that this phenomenon is contributory to the failure of the coating. It is possible that the sulfate, present either as the metallic sulfate or occluded sulfate ion, upon being leached from the coating produces voids in the coating which then become focal points for corrosion of the metal beneath.

The role of the sulfuric acid appears to be one of reacting with the base metal and at the same time releasing hydrogen which reduces some of the hexavalent chromium to the trivalent state thus providing the two chromium ions necessary for formation of the colloidal film, $Cr_2O_3.CrO_3.XH_2O$. This also explains why an increase in sulfuric acid concentration tends to increase the amount of chromium in the coating because the greater amount of Cr^{+++} formed the greater the possibility for the formation of the above mentioned colloidal film.

Since the corrosion resistance is not enhanced by the additional amount of coating, as evidenced by chromium content on the coupon, it is reasonable to presume that the sulfate ion or metallic sulfate formed as a by-product of the oxidation-reduction reaction proves deleterious by weakening the colloidal film. It also appears that the larger the amount of sulfate in the coating the more easily it is removed since the percentage removed is approximately the same, indicating that a greater amount is removed from the coatings containing more sulfate.

Based on the results of the work reported it has been found that there is no advantage of nitrate con-

taining solutions over sulfate containing solutions as regards corrosion resistance. This answers the question of paramount interest mentioned at the beginning of this article.

It is believed that the information obtained and the theories evolved therefrom should provide for a better understanding of the supplementary dip treatment for zinc and cadmium plated work.

Acknowledgment

The authors wish to express their appreciation to their co-workers at the Rock Island Arsenal Laboratory for their assistance and to the Ordnance Corps, Research and Development Division of the Department of the Army and the Supervisory Staff of the Laboratory for permission to publish the information in this paper.

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Third Annual Interim Meeting

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Plan to attend this important Society meeting. Tentative plans and reports will be presented in connection with the Annual AES Convention in New York City, July 12–15, 1954.

For delegates primarily but all AES members are invited. A feature of the Interim Meeting will be nominations for National Third Vice-President.

TIME OF MEETING:—SATURDAY—10 a.m.

Tentative Program and Agenda

Time	*Event*
10:00–10:15	Opening Remarks
10:15–10:30	Finances
10:30–11:00	Membership and AES Facts
11:00–noon	Branch Officers' Manual
noon–12:30	Open
12:30– 1:55	Luncheon
2:00– 2:15	Executive Secretary's Report
2:15– 3:00	Editorial Board
3:00– 3:30	Broadening of the Society Base
3:30– 4:00	Research and Sustaining Membership, Process Control Handbook
4:00– 4:15	Advertising Manager's Report
4:15– 4:30	Delegates Handbook
4:30– 4:45	Nominations for Third Vice-President—Open
4:45– 5:00	New York City Convention Report
5:00– 5:30	Cocktail Hour

Come early and be guests of the Toronto Branch at its Annual Meeting at the York Hotel Friday, February 12

To assist National Headquarters in its planning, members should notify the Executive Secretary if they plan to attend.

The following paper is a result of the work sponsored at Lehigh University by the AES and the Ohio River Valley Water Sanitation Commission. While the original procedure was worked out under AES sponsorship, the modification was developed under ORSANCO sponsorship, the commission having sponsored the project at Lehigh so as to be able to utilize the background developed by AES Project No. 2.

THE COLORIMETRIC DETERMINATION OF ZINC IN EFFLUENTS

R. F. MURACA*, D. G. GARDNER†, AND E. J. SERFASS‡

ABSTRACT

A colorimetric procedure for the determination of the zinc content of effluents in the range of 5 to 50 ppm is presented. The method was found to give satisfactory results in the presence of 100 to 5000 ppm of each of 25 ions in simultaneous admixture.

The method is a monocolor procedure employing dithizone as the color forming reagent. Interfering elements are eliminated by cupferron extraction and by complexing with cyanide and thiosulfate. After removal of the excess dithizone, the intensity of the red zinc-dithizone complex is measured with a colorimeter.

The procedure can be materially shortened if the concentration of each substance other than zinc is below 1 ppm. A table summarizes the changes that can be made when the amounts of the materials other than zinc are known or can be estimated.

Modified procedures for the analysis of water samples where the concentration of zinc is as low as 0.01 ppm, are also included.

THE PROCEDURES

The colorimetric determination of trace quantities of zinc is most conveniently carried out by the use of diphenylthiocarbazone (dithizone) in cyanide-thiosulfate medium at a *p*H of 5.0 to 5.5. Numerous investigators have developed schemes of analysis for zinc in the presence of a wide range of impurities such as in plating baths[1], biological matter[2], and minerals[3].

This method is based upon the fact that a cyanide-thiosulfate medium renders harmless a large number of elements which ordinarily would interfere with the extractions of zinc as the dithizone complex at a *p*H of 5.0 to 5.5.

Complexing agents, such as the alkyldithiocarbamates, have been used to render the action of dithizone nearly specific for zinc[5,6]. However, the advantages of these reagents over thiosulfate and cyanide as a complexing medium are limited, and the manipulations involved are as numerous as those in the method recommended here.

The proposed method is a modification of the monocolor method of Sandell[7].

Description of the Method

A preliminary fuming with nitric and sulfuric acids is carried out to decompose organic material that may retain zinc in a form which will not react with dithizone. Hydrochloric acid is added to the digestion mixture after the fuming in order to precipitate silver. Insoluble substances remaining after dilution of the digestion mixture are removed by centrifugation or filtration. Cupferron is added to complex iron and copper, and the cupferrides are extracted with chloroform.

The solution is made basic and cyanide is added to complex the nickel and cobalt. The *p*H of the solution is adjusted to about 5.5 and thiosulfate is added to elimi-

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‡Head, Department of Chemistry, Lehigh University, Bethlehem, Pa.

nate interference from mercury, lead, bismuth, copper, cadmium, tin, and manganese.

The solution is extracted with dithizone in carbon tetrachloride, the excess dithizone is removed by washing with a weak solution of sodium sulfide, and the intensity of the resulting red color is measured at 535 millimicrons in a spectrophotometer or in a colorimeter equipped with a suitable filter.

The recommended procedure was found to give excellent results for concentrations of zinc in the range of 5 to 50 ppm in solutions containing in simultaneous admixture 100 ppm each of Hg^{++}, Bi^{+++}, Cu^{++}, Cd^{++}, Sn^{++}, 5000 ppm each of the following ions: Ag^{+}, Pb^{++}, As^{+++}, Sb^{+++}, Cr^{+++}, Al^{+++}, Fe^{+++}, Mn^{++}, Ni^{++}, Co^{++}, Ca^{++}, Sr^{++}, Ba^{++}, Mg^{++}, Na^{+}, K^{+}, NH_4^{+}, CNS^{-}, PO_4^{---}, SO_3^{--}, and organic materials such as tartrates and acetates.

Sensitivity of the Recommended Procedure

The sensitivity of the method is defined as the smallest number of micrograms of zinc ion that must be contained in the 5 ml sample taken for analysis in step 1 in order that this quantity can be determined with a maximum relative error of ±50 per cent. It has been ascertained that the recommended procedure is capable of a sensitivity of at least 25 micrograms (5 ppm). The method is actually capable of an accuracy of ±5 per cent at 5 ppm,; however, there are numerous factors, such as coprecipitation, solid solutions, that control the accuracy of the determination; and for the high concentrations of substances that are liable to be present in effluents, these factors may operate to decrease the accuracy with which the zinc may be determined.

It is for this reason that a ±50 per cent relative error has been selected instead of the ±5 per cent that usually can be realized.

Limit of Detection of the Recommended Procedure

The limit of detection of the method is defined as the minimum number of micrograms of zinc ion that must be present in the 5 ml sample taken for analysis in step 1 so that an extinction of about 0.005 will be obtained in step 17 for a 1 cm cell thickness at 535 millimicrons. For the recommended procedure, the limit of detection is 2.5 micrograms of zinc ion (0.5 ppm).

Discussion of the Blank

A blank must be run along with the sample since the reagents and the glassware used in the determination contain a surprisingly large amount of zinc. In addition to the error which may be introduced by the accumulation of zinc from various sources, an additional error will develop from the oxidation products of the dithizone used in the extraction. It will be found, in using this procedure, that the extinction of the blank will be quite high.

Satisfactory results can be obtained only if the blank is faithfully carried through the same steps along with the sample.

Special Precautions

Dithizone is the only reagent that has been found satisfactory for the direct colorimetric determination of zinc in low concentration in the presence of many other elements. However, it has not been widely used since, in general practice, contamination from glassware and reagents gives erratic results. This inability to obtain reproducible results has caused operators to refute the value of dithizone as a reagent for zinc or has caused them to doubt the value of the analytical procedure.

It has been found that ordinary glass containers are by far the largest source of zinc contamination to chemicals and solutions stored in them. For this reason, all reagents must be rendered zinc-free in order to obtain a low blank. Furthermore, it is strongly recommended that these purified reagents be stored in plastic bottles.

All glassware, especially the separatory funnels used in the extractions, should be thoroughly washed, rinsed with concentrated nitric acid, and then rinsed well with zinc-free distilled water. Separatory funnels should be kept stoppered as much as possible, and the plugs should be greased with silicone grease.

The solubility of glass is at a minimum in hot concentrated acids and consequently very little contamination of the sample will result during the fuming steps of the procedure. It is possible to eliminate zinc contamination from this source by the use of silica vessels when fuming the sample, in fact, the use of silicaware in place of glassware will eliminate all possibilities of contamination from vessels and equipment. Plastic is a satisfactory substitute for beakers, bottles, etc.

Water may be made nearly free of zinc by distillation in Pyrex equipment. Ideally, a silica still and receiver could be employed. The purified water should be stored in containers of silica, plastic or glass, the last named being coated with silicones. For routine laboratory work, water taken directly from a laboratory still with a block tin condenser will be found satisfactory.

Recommended Procedure

This procedure is designed to be used for the determination of 5 to 50 ppm of zinc in a 5 ml sample of effluent.

Reagents Required

(1) Nitric acid concentrated, 16 N; reagent grade.
(2) Sulfuric acid 36 N; reagent grade.
(3) Hydrochloric acid concentrated, 12 N; reagent grade.
(4) Cupferron solution 5 per cent w/v in zinc-free distilled water. Prepare fresh as needed.
(5) Chloroform reagent grade; preferably redistilled over calcium oxide prior to use.

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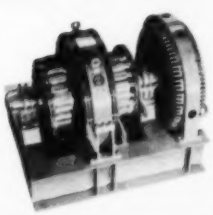

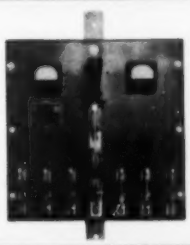

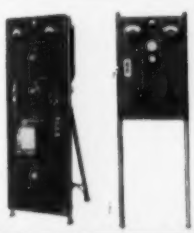

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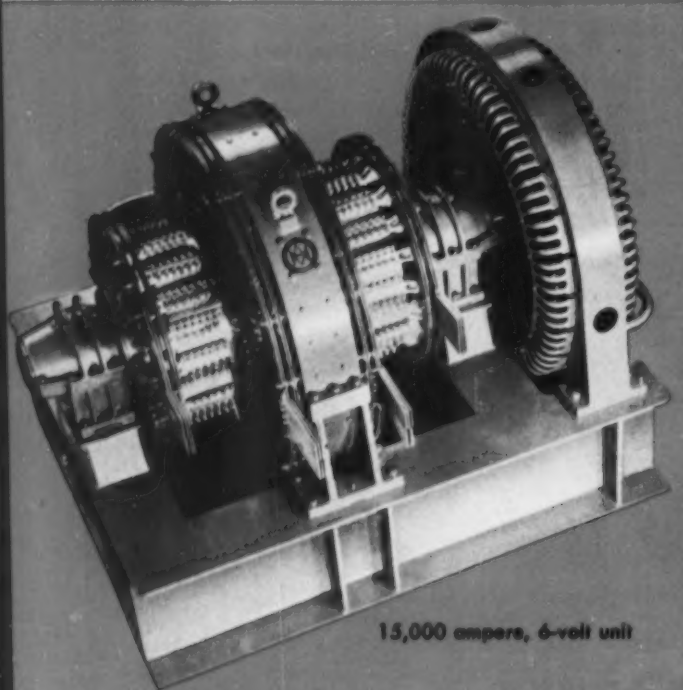

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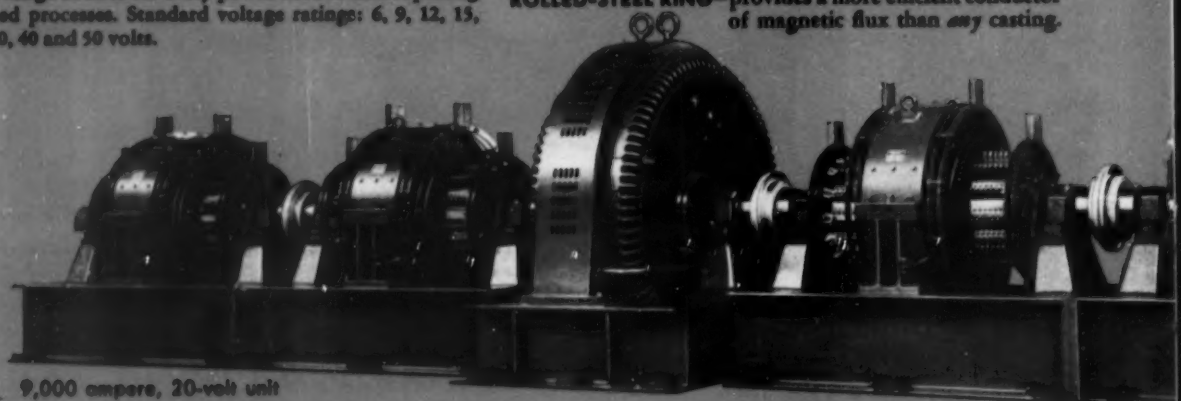

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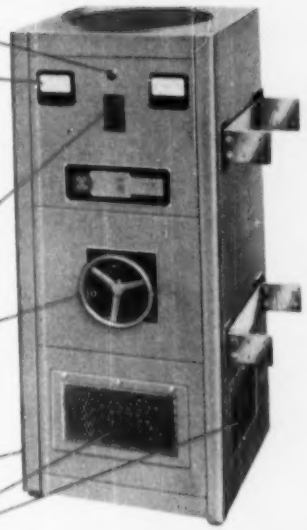

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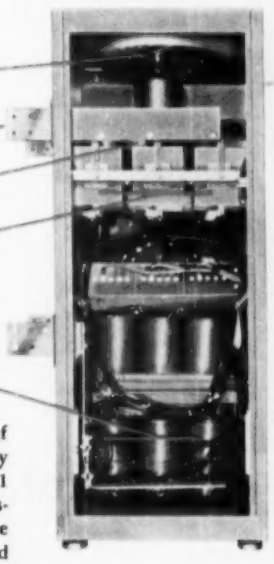

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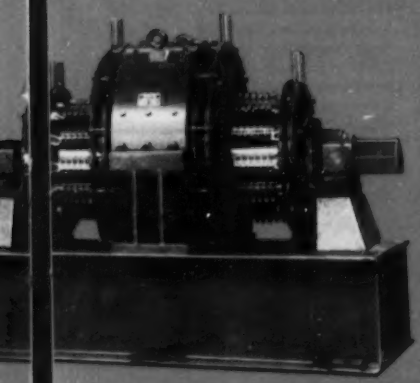
For complete information on H-VW-M Generators ask for Bulletin G-102.



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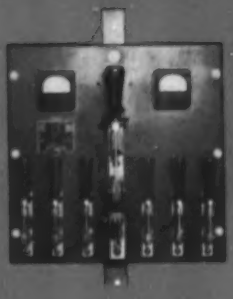

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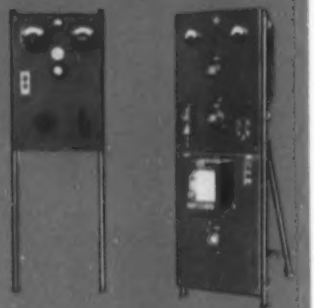

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(6) Carbon tetrachloride reagent grade; redistilled over calcium oxide prior to use.

(7) Ammonium hydroxide concentrated: Pass ammonia gas from a cylinder into zinc-free distilled water in a plastic container kept cold by immersion in an ice bath. Store in a plastic container.

(8) Sodium cyanide solution 5 per cent w/v in zinc-free distilled water. Store in a plastic container.

(9) Sodium acetate solution 0.5 M. This solution is made zinc-free by extraction with 0.01 per cent dithizone in carbon tetrachloride. The dithizone and yellow oxidation product of dithizone are removed by extraction with successive portions of chloroform until the latter extracts remain colorless. The solution is then extracted with carbon tetrachloride to remove any chloroform. Store in a plastic container.

(10) Sodium thiosulfate solution, 50 per cent w/v in zinc-free distilled water. Store in a plastic container.

(11) Dithizone, 0.01 per cent in carbon tetrachloride: Since even reagent grade dithizone may be contaminated to some degree by the oxidation product of dithizone (diphenylthiocarbodiazone), the following procedure is strongly recommended for preparing the dithizone solution.

Dissolve 100 mg of pure dithizone in 50 ml of chloroform. Filter the solution through paper into a separatory funnel. Extract with three 50 ml portions of 1 per cent ammonium hydroxide. Discard the chloroform and extract the ammoniacal solution with three 10 ml portions of carbon tetrachloride. Reject the carbon tetrachloride extracts. Precipitate the dithizone from the ammoniacal solution with 2 ml of concentrated HCl. Now extract the solution with carbon tetrachloride until the aqueous layer becomes colorless, or almost so. Combine the extracts and dilute to one liter with carbon tetrachloride.

(12) Sodium thiosulfate-acetate wash solution: Mix 225 ml of 0.5 M sodium acetate solution, 10 ml of 50 per cent sodium thiosulfate solution, and 40 ml of 10 per cent nitric acid, and add water to make 500 ml of solution. Remove traces of zinc by shaking with dithizone as prescribed with the 0.5 M sodium acetate solution. Store in a plastic container.

(13) Sodium sulfide solution, 1 per cent w/v in zinc-free distilled water. Store in a plastic container.

(14) Sodium sulfide wash solution: Dilute 40 ml of 1 per cent sodium sulfide solution to one liter with zinc-free distilled water. Store in a plastic container.

(15) Standard zinc solution: Dissolve 100 mg of reagent grade zinc in 10 ml of 1:1 HCl and dilute to one liter with zinc-free distilled water. Store this solution in a plastic container. Pipette 25 ml of this solution into a 100 ml flask and dilute up to the mark with zinc-free distilled water. This latter solution, which is the *Standard Zinc Solution*, should be stored in a plastic container and labeled:

1 ml = 25 micrograms of zinc

For establishing a calibration curve, 1 ml of this solution taken as a sample corresponds to 5 ppm of zinc for a 5 ml sample of effluent taken for analysis in step one of the recommended procedure.

Recommended Procedure for the Determination of Zinc

(1) Pipette a 5-ml sample of the effluent into a 125-ml Erlenmeyer flask (preferably silica).

In running a blank, use 5 ml of zinc-free distilled water.

In establishing a calibration curve, use 5 ml of zinc-free distilled water and add 1 ml of the standard zinc solution for each of 5 ppm of zinc.

(2) Add 5 ml of concentrated nitric acid and 1 ml of concentrated sulfuric acid and evaporate to strong fumes of SO_3. Gently fume for 5 minutes. If the residue after fuming is discolored by organic carbon, cautiously add 2 ml of concentrated nitric acid and fume again. Repeat as many times as is necessary. More concentrated sulfuric acid may be needed to prevent the mixture from going to dryness.

(3) Cool the solution and dilute with about 25 ml of water.

Add 0.5 ml of concentrated hydrochloric acid.

(4) Filter the solution, if necessary, through Whatman No. 42 paper, saving the filtrate. Centrifugation is preferable.

Wash the filter at least three times with 5-ml portions of water. Combine the filtrate and washings.

(5) Transfer the filtrate and washings to a 100-ml volumetric flask and dilute to the mark with water.

(6) Pipette a 10-ml aliquot from the above solution into a 150-ml beaker.

Add 0.2 ml of concentrated sulfuric acid.

(7) Transfer the solution to a separatory funnel. Chill by immersing the funnel in an ice bath.

Add 5 ml of the 5 per cent cupferron solution and shake very well. Let stand in the ice bath for at least one minute with an occasional swirling.

(8) Extract the solution in the separatory funnel with separate 10-ml portions of chloroform until the chloroform layer remains clear. Reject the chloroform extracts.

Extract with one 5-ml portion of carbon tetrachloride and reject this extract.

(9) Transfer the water solution from the separa-

TABLE I. SUMMARY OF CHANGES IN RECOMMENDED PROCEDURE WHEN SAMPLE COMPOSITION IS KNOWN

Composition of Effluent	Changes in the Recommended Procedure for the Determination of Zinc
Organic matter absent	Omit steps 1 to 5 inclusive. Pipette 5 ml of the sample into a 150-ml beaker, add 0.5 ml of concentrated HCl, filter if necessary, transfer to a 100-ml volumetric flask, and dilute to the mark. Proceed with step 6 of the recommended procedure.
Organic matter absent and Sn^{++} below 1 ppm	Omit steps 1 to 6 inclusive. Pipette 5 ml of the sample into a 150-ml beaker, add about 50 ml of water, 10 ml of concentrated HCl, filter if necessary, transfer to a 100-ml volumetric flask, and dilute to the mark. Use a 10-ml aliquot of this solution and start with step 7 of the recommended procedure.
Organic matter absent, Sn^{++} below 1 ppm, and iron below 100 ppm	Omit steps 1 to 9 inclusive. Pipette a 5-ml sample into a 150-ml beaker, add 0.5 ml of concentrated HCl, filter if necessary, transfer to a 100-ml volumetric flask, and dilute to the mark. Pipette a 10-ml aliquot of this solution into a 150-ml beaker and start with step 10 of the recommended procedure.
Organic matter absent, Sn^{++} below 1 ppm, iron below 100 ppm, and Ni^{++} and Co^{++} below 1 ppm	Omit steps 1 to 10 inclusive. Pipette a 5-ml sample into a 150-ml beaker, add 0.5 ml of concentrated HCl, filter if necessary, transfer to a 100-ml volumetric flask, and dilute to the mark. Pipette a 10-ml aliquot of this solution into a 150-ml beaker, add 25 ml of 0.5 M sodium acetate, and adjust to a *p*H of 5.0 to 5.5 with concentrated HCl or NH_4OH. Start with step 11 of the recommended procedure.
Organic matter absent, Ag^{+}, Hg^{++}, Pb^{++}, Bi^{+++}, Cu^{++}, Cd^{++}, Sn^{++}, Fe^{+++}, Mn^{++}, Ni^{++}, and Co^{++} below 1 ppm, and all other elements below 100 ppm	Omit steps 1 to 11 inclusive. Pipette a 5-ml sample into a 100-ml volumetric flask and dilute to the mark. Pipette a 10-ml aliquot of this solution into a 150-ml beaker, add 25 ml of 0.5 M sodium acetate, adjust to a *p*H of 5 to 5.5 with concentrated HCl or NH_4OH, add 10 ml of 50 per cent $Na_2S_2O_3$, and transfer to a separatory funnel and proceed with step 12 of the recommended procedure.
Organic matter present, Hg^{++}, Bi^{+++}, Cu^{++}, Cd^{++}, and Sn^{++} below 100 ppm and all other elements below 5000 ppm	Follow the recommended procedure.

tory funnel to a 150-ml beaker. Wash out the separatory funnel with a little water and add this washing to the contents of the beaker.

(10) Add concentrated ammonium hydroxide to the solution in the beaker until it is distinctly alkaline.
Add 15 ml of 5 per cent sodium cyanide solution.
Add concentrated hydrochloric acid and adjust the *p*H of the solution with a *p*H meter to 3–4. (Caution, perform this operation under a hood.)
Add 25 ml of 0.5 M sodium acetate and adjust the *p*H of the solution to between 5.0 and 5.5 with concentrated HCl or NH_4OH.

(11) Transfer the contents of the beaker to a 125-ml separatory funnel.
Add 20 ml of 50 per cent solution of sodium thiosulfate, and shake the contents of the flask well.

(12) Extract the contents of the separatory funnel with 5 ml of a 0.01 per cent solution of dithizone in carbon tetrachloride.
Transfer the carbon tetrachloride layer to a clean separatory funnel.
Extract the water solution in the first separatory funnel with another 5-ml portion of 0.01 per cent dithizone in carbon tetrachloride.
Continue to extract with dithizone until the extracts remain green in color showing that all the zinc has been removed.

(13) Wash the combined dithizone extracts with two 10-ml portions of the sodium thiosulfate-acetate wash solution. Reject the washings.

(14) Wash the combined dithizone extracts with 10-

TABLE II. SHORTENED PROCEDURE FOR ZINC IN THE RANGE 0.01 TO 5 PPM WHEN HEAVY METAL CONCENTRATION IS LOW

Composition of the Effluent	Shortened Procedure
Zinc in the range 0.01 to 0.1 ppm Alkali and alkaline earth metals below 10 ppm and all other elements below 1 ppm Organic matter absent	Take a 100-ml sample of effluent. Add 10 ml of a 10 per cent sodium citrate solution and 1 ml of concentrated NH_4OH (the *p*H should be between 8-9). Extract with three 5-ml portions of 0.01 per cent dithizone in CCl_4. Shake the combined dithizone extracts with 20 ml of 0.01 N HCl. Separate the acid layer, adjust its *p*H to 5.0 to 5.5 with 0.5 M sodium acetate, add 5 ml of 50 per cent $Na_2S_2O_3$, and extract with 3-ml portions of 0.01 per cent dithizone in CCl_4 until the extracts remain green in color. Wash with 5-ml portions of 0.04 per cent Na_2S until the wash solution remains clear, and dilute to 50 ml with CCl_4 in a volumetric flask. Read on a colorimeter with a green filter.
Zinc in the range 0.1 to 1 ppm All other materials at the concentrations listed above	Use a 10-ml aliquot of the 100-ml sample and follow the above procedure.
Zinc in the range 1 to 5 ppm All other materials at the concentrations listed above	Take a 10-ml sample; use a 1-ml aliquot and follow the above procedure.

ml portions of the sodium sulfide wash solution until no more color is extracted.

(15) Filter the red zinc-dithizone complex in the separatory funnel through a small paper filter into a 50-ml volumetric flask. Wash the paper filter well with carbon tetrachloride.
Dilute up to the mark with carbon tetrachloride and shake.

(16) Set the Klett-Summerson colorimeter to zero with carbon tetrachloride. Use a green (No. 54) filter. With a spectrophotometer, set the instrument to read 100 per cent T at 535 millimicrons.

(17) Transfer the solution from step 15 to the sample cuvette and read the colorimeter.

(18) If necessary, convert the scale readings of the photometer to density. Subtract the blank reading from the sample reading. If a calibration curve is being established, plot these corrected readings versus ppm of zinc. If a sample is being run, read the amount of zinc from the calibration curve.

Variations of the Recommended Procedure

If the composition of the effluent is known, the recommended procedure for zinc can be materially shortened.

Table I summarizes the changes that can be made in the recommended procedure for zinc when the composition of the sample is known. Unless otherwise stated, the concentrations of Hg^{++}, Bi^{+++}, Cu^{++}, Cd^{++} and Sn^{++} should not exceed 100 ppm, and the concentrations of other elements should not exceed 5000 ppm. For effluents containing greater quantities of these elements, dilution will be necessary. The effluent should be between *p*H 2 and 9.

A Shortened Procedure for Zinc in the Range 0.01 to 5 ppm

The procedure outlined in Table II is designed for the analysis of water samples where the concentrations of each of the heavy metals including zinc are very low and the only elements of appreciable concentration are the alkali metals and alkaline earths. The effluent should be nearly neutral (between *p*H 2 to 9). Do not omit blanks.

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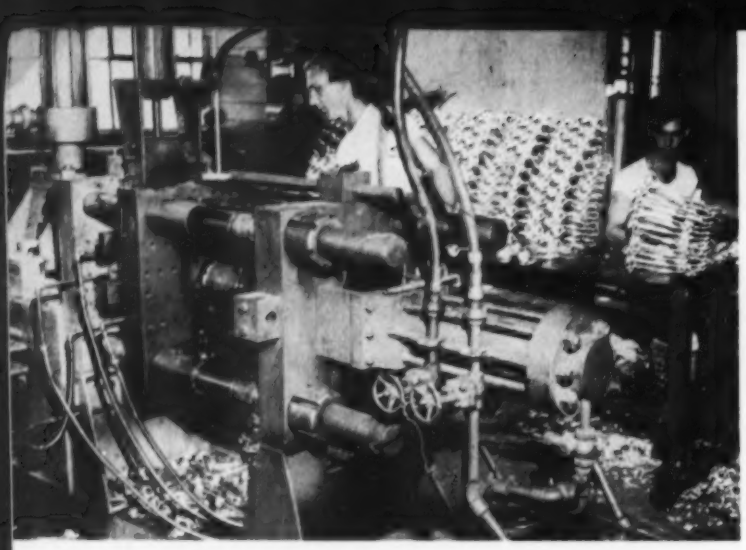
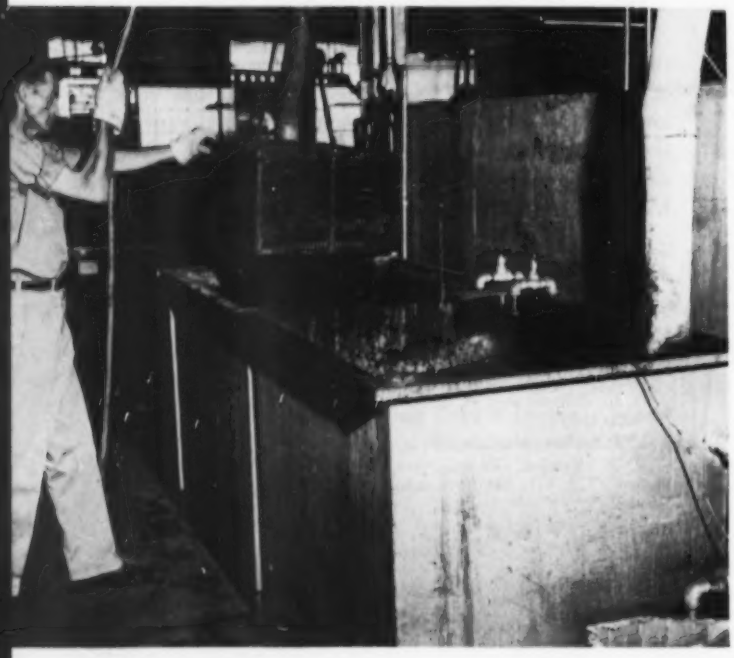


Yoder has developed its own high-speed zinc die-casting machines, one of which is shown here turning out bicycle horns under the eye of Billy Lake. At right, Ray Almond trims the flash from the horn bodies. Fred Hollis, Yoder's plant superintendent, says: "The die cavity must have a high lustre finish comparable to the mold for plastic injection-molding, in order to get the best results from plating. At regular intervals the die cavity must be repolished, to insure getting a smooth surface on the casting"

BICYCLE *coated* VACUUM

After degreasing, the zinc die-cast horns are given a light phosphate coating by dipping, as George Case is doing here. This coating, while not absolutely essential, has been adopted because it gives a quality plating job. The coating provides extra corrosion protection, but, more important, produces a roughening of the surface of the zinc which promotes a better bond between it and the coat of lacquer which is applied next



The Yoder Manufacturing Company started in business in 1942, in Los Angeles, producing various electrical assemblies for the aircraft plants there and doing die-casting on a jobbing basis for the same firms and for the U. S. Army's Ordnance Department and Signal Corps. In 1947, with aircraft orders slackening, the company switched to making toys, novelties and certain hardware items and built up a handsome business with distribution all over the United States and in many foreign countries.

In 1951, the company moved to Little Rock, Ark., where it now occupies larger quarters in a building that formerly had been used for assembling airplanes. It expanded its line of products to include automobile accessories and developed a line of bicycle and toy horns which grew to be a biggest seller. It is turning them out at the rate of 20,000 per eight-hour day, at the moment, and a company spokesman ruefully admits that, for the first time in its business life, the company is a little behind in filling orders.

This happy state, which other toy manufacturers might envy, is attributed to the much lower prices company salesmen have been able to quote since costs have been cut by the mechanization of production, by the installation of company designed high-speed die-casting machines and by an efficient handling system which also was company designed.

HORNS *by* METALIZING

The horn bodies are next loaded on specially designed fixtures, each holding 16 units, where they will remain without further handling through the rest of the finishing process. Mary Burford, right, loads a fixture, while Gene Witcher, left, places a full one in the wheeled rack on which they travel through succeeding operations

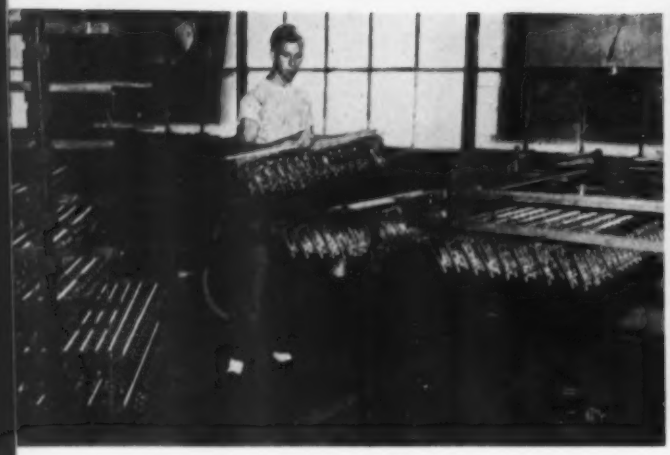
The company also installed its own modern finishing equipment, including electrostatic spray booths, ingenious lacquering dip tanks, and a 48-inch vacuum metalizing unit manufactured by the F. J. Stokes Machine Co., Philadelphia, Penna.

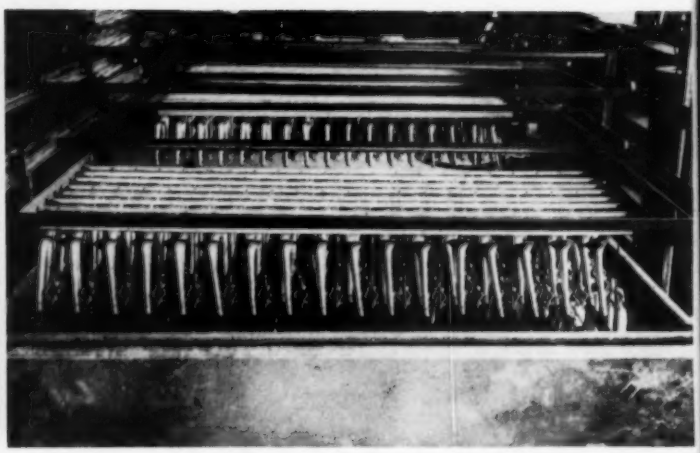
Until converting to vacuum metalizing in January of 1953, the Yoder Manufacturing Company had always finished die-cast zinc horns with a chromium electroplate which was subcontracted to various job shops.

Now, the horns, including the clamps, are finished by depositing a thin layer of aluminum under vacuum in the metalizer. Production costs for the new finishing method are about one-sixth that for electroplating. The savings are traceable largely to the fact that the horns now need no buffing or polishing.

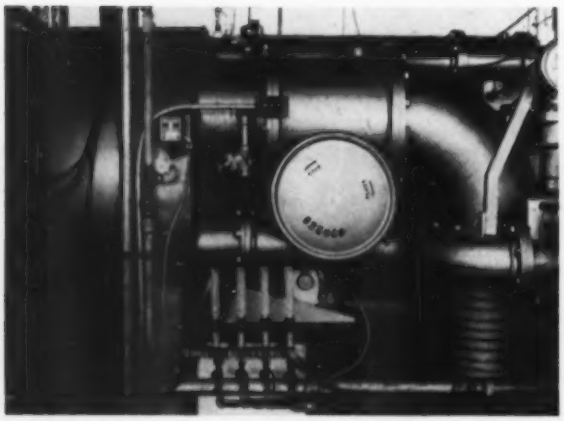
But besides the attractive saving in production costs, the company likes the end-results obtained by vacuum plating. "The die-cast zinc horns have a much higher lustre and greater eye appeal than we used to get from chromium plating," a spokesman says. A line of low-cost horns molded of acetate plastic, which also are finished by vacuum metalizing, has been added because of the vacuum coating process. It is the only method the Yoder concern has found to give a high-lustre metallic finish over acetate plastic at low cost.

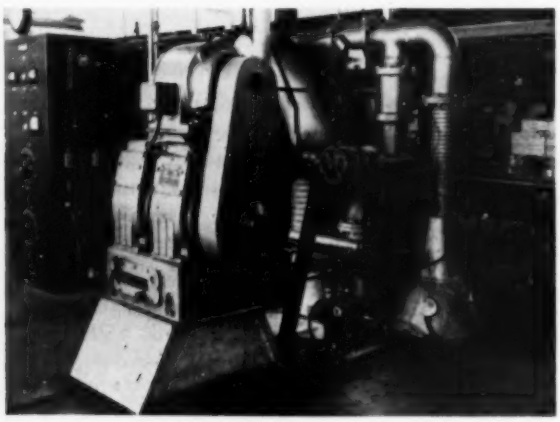
Special fixtures hold the castings which form the clamp for the horn





(Left) John Lake loads the fixtures into a special conveyor designed by Yoder, which carries the horns up to the lacquer dip tank. (Right) The lacquer dip tank is raised by a hydraulic jack until the lacquer completely covers the horns, then is lowered very slowly so that the coating of lacquer is perfectly uniform and free of runs. This smooth, slick undercoating is exactly duplicated by the metalized coating, and hence this technique is one of the key steps that are largely responsible for the smooth, brilliant, appealing finish of the final product

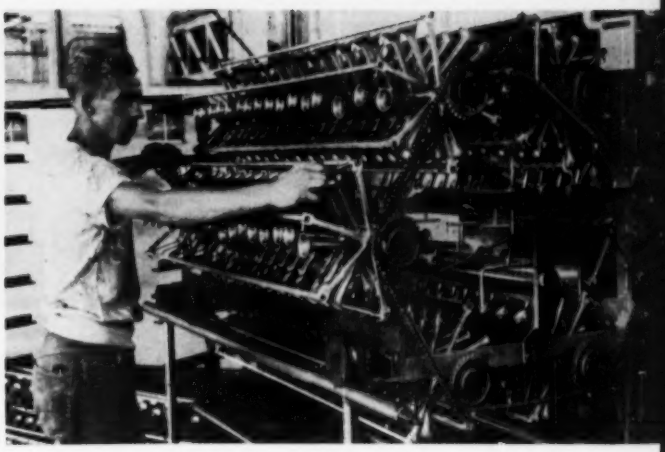




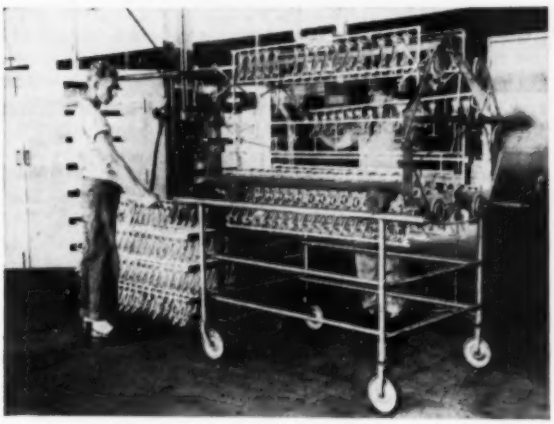
(Left) These four thermometers in the cooling-water coils serving the two oil diffusion pumps, booster pump and mechanical pump help the operator to keep the oil at a uniform temperature, thus balancing the performance of the pumps and increasing the overall efficiency of the pumping equipment. (Right) Compact and clean in layout, a 48-inch metalizing unit, including the vacuum pumping system, takes up only 150 square feet of floor space

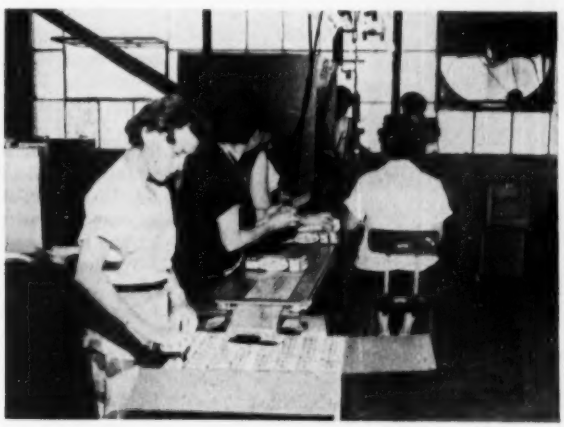
Production and finishing techniques that Stan Yoderand plant superintendent, Fred Hollis, have worked out are shown in the accompanying pictures. They freely acknowledge, also, with gratitude, the advice and assistance they received from Gordon Seiter, head of the vacuum metalizing department of F. J. Stokes Machine Company. They tried out numerous lacquers and methods of applying them, and variations in the duration of the flashing current, and the procedures finally adopted represent just about the last word in refinements of this important new method.

Incorporated in their control panel is an automatic time-cycler to provide perfect uniformity of flashing current duration for every production cycle. Ther-



(Left) The lacquered horns, loaded back into the racks, are wheeled into the ovens where they are baked for 35 minutes. The lacquer coating closes the pores of the zinc die-casting and seals in the plasticizer of the acetate plastic, thus speeds up the pump-down of the chamber by preventing out-gassing from the horns. This quickens the vacuum processing cycle, and contributes to a smooth surface. (Right) When the lacquer coat has been fully cured, the horns are loaded onto the "spiders" of the metalizing unit. The chain drive rotates these spiders during the flashing period when the aluminum is being vaporized so that all parts of the horns are brought into the line of fire and are coated with their full share of metal. The filaments on which the aluminum staples are hung can be seen in the center of the rack of six spiders, running longitudinally through the chamber





(Left) Metalized horns are unloaded from the rack and given a second lacquer dip which, like the first, is then baked for 35 minutes. The hard, tough coating protects the brilliant and lustrous metallic finish. Properly applied, the vacuum metalized finish can withstand 250 hours of salt spray without visible deterioration. If desired, the lacquer overcoat can be dyed to give a gold color or to simulate any other metallic hue. (Right) The finished horns are assembled with clamp and rubber bulb and packed for shipment

mometers also were installed in each of the cooling-water lines for the metalizer's oil diffusion pumps, booster pump and mechanical pump which were found to be instrumental in balancing the performance of the pumps. This not only helped to save on the consumption of cooling water, but it also increased the efficiency of the vacuum pumps and thus lowered the total pump-down time for each cycle.

The complete finishing procedure, involving degreasing, a phosphate dip (for the zinc die-case horns only), lacquering, metalizing, and a second lacquering to protect the finish, gives the company a product with tremendous consumer appeal and a brilliant finish that will withstand 250 hours of salt spray.

41ST ANNUAL AES CONVENTION

JULY 12-15, 1954

Full Schedule Planned for Ladies Attending 1954 Convention

For the first time in seventeen years, the New York Branch will play host to the American Electroplaters' Society at their annual convention to be held July 12 through July 15, 1954 at the Hotel Statler.

Mrs. Schore

The Ladies' Committee has prepared what promises to be a most full and entertaining week for the women attending the convention.

On Sunday, July 11, a "get-together" party has been scheduled for the early registrants. An outstanding film on New York City by Terry Manos, entitled "*The Twenty-four Dollar Purchase,*" will be shown. Refreshments will be served following the film presentation.

Monday morning will bring the official opening to the convention and will feature talks by outstanding personalities. A tea party will be given on Monday afternoon, the feature of the tea being a talk of great interest to the ladies. Monday night will feature the Fellowship Open House with one of the leading orchestras of the country and food galore. As always, this party will be sponsored by the METAL FINISHING SUPPLIERS' ASSOCIATION.

On Tuesday, July 13, OAKITE PRODUCTS INC., will once again sponsor the "Aunt Ella" luncheon, which is always one of the annual high lights of the convention. It will be held at the famous Tavern on the Green, and will feature DAVE CLARIN as AUNT ELLA. In the evening, the UDYLITE CORPORATION will sponsor an evening's entertainment at one of the leading Broadway plays.

Wednesday, July 14, will be "Outing Day." A pleasant sail up the Hudson River to Bear Mountain has been planned with the following activities: luncheon, the East-West ball game, swimming, boating, etc. The complete day will be under the sponsorship of the FREDERICK GUMM CHEMICAL COMPANY. This outing is for all men and women registered at the convention.

Thursday will bring visits to the United Nations or Radio City, both of which are sponsored by the BART-MESSING and SEL-REX CORPORATIONS. Also on Thursday, JOAN WIARDA will act as hostess at the annual Plato Party. Gifts and prizes will be given at the party. The Grand Banquet will be held Thursday evening, featuring an excellent meal, an all-star Broadway review and dancing.

Souvenirs and gifts will be given during the convention. One which has already been pledged by the RAPID ELECTRIC COMPANY, an orchid to each lady, will be given the night of the final banquet. Cocktail parties will be given throughout the convention.

There will be time to visit, shop and see the sights. A committee has been appointed to fulfill your every wish. The committee will be looking for you July 12 to July 15, 1954—plan to attend.

The Ladies' Committee: Mrs. Barbara Schore, Chairman; Mrs. Ethel Braun, Mrs. Molly Cates, Mrs. Margaret MacStoker, Advisory; and Mrs. Rose Cinamon, Mrs. Tillie Cooperman, Mrs. Yolande Fusco, Mrs. Edith Goldwasser, Mrs. Mildred Hartshorn, Mrs. Winnie Herrmann, Mrs. Bessie Nadel, Mrs. Rose Schmidt.

THE NATURE, CAUSE AND EFFECT OF THE POROSITY IN ELECTRODEPOSITS

I. THE POROSITY OF ELECTRODEPOSITS†

(Continued from the January, 1954 issue)

project no. 13

project director:

FIELDING OGBURN*

associate:

ASAF BENDERLY*

location:

NATIONAL BUREAU OF STANDARDS

Acknowledgment is due the Research Committee; the Research Directing Subcommittee; and the Project Committee consisting of Mr. Clarence Sample, Chairman, Dr. William Blum, and Mr. August Mendizza.

*AUTHORS

Permeability Measurements on Foils Subjected to Accelerated Corrosion

In view of the limitations involved in measurement of initial permeability it appeared more promising to measure and compare the rates at which foils become porous when corroded. Ideally, accelerated methods of producing corrosion should simulate the types of failure obtained in atmospheric exposure.

In previous work, the vapors of concentrated hydrochloric acid were employed as a corrodant. Exploratory experiments were made, primarily employing the gas permeability method, in order to evaluate hydrochloric acid vapors and other accelerated corrosion agents. In these tests, two general types of corrosion were obtained. One type, referred to as "depth corrosion," denotes corrosion in which perforation of the foil occurs with little loss in weight. The areas between the pores remain substantially uncorroded. This is similar to the type of failure suffered by nickel coatings in the atmosphere. The other type of corrosion, referred to as "surface corrosion," denotes corrosion in which rather uniform attack of the foil takes place over the entire surface. Here, perforation does not occur until a substantial part of the weight of the foil is lost.

The details of these preliminary experiments follow:

Hydrochloric Acid Corrosion Test

A. Five small foils were cut from each of two large foils plated simultaneously on either side of the same cathode. All ten foils were virtually impermeable initially and were corroded for 7.5 hours over 12N hydrochloric acid in a desiccator. The corroded foils were washed, dried, and remeasured for permeability.

The results, which appear in Table III, indicate a large variation in the extent of corrosion from foil to foil. This variation may have resulted partly from erratic condensation of hydrochloric acid droplets on particular foils. The nonreproducibility and nonuniformity of the corrosion were further illustrated by continued corrosion of foils NN–1, 2, 3, and 5. All four were simultaneously corroded for additive periods of time, and after each period were measured for permeability. These data are summarized in Table IV. It should be noted that the rate of corrosion varied with time and there appears to be no uniform variation of the rates of the different foils.

Modified Hydrochloric Acid Corrosion Test

B. A hydrochloric acid corrosion cham-

†In partial fulfillment of the requirements for the degree of Master of Chemical Engineering at the Polytechnic Institute of Brooklyn. In this regard, one of the authors, Asaf Benderly, acknowledges the help of his thesis advisor, Dr. Roger Gilmont.

TABLE III. PERMEABILITIES OF FOILS CORRODED OVER 12N HYDROCHLORIC ACID FOR 7.5 HOURS

Foil	Thickness (microns)	Permeability Coefficient "k" (liter/sq cm/min)
N–1	22.6	3×10^{-4}
2	21	2×10^{-5}
3	21	3×10^{-4}
4	23	4×10^{-5}
5	22.6	3×10^{-5}
NN–4	26	4×10^{-4}
1	29.6	2×10^{-5}
2	27.4	3×10^{-5}
3	26	1×10^{-6}
5	28	3×10^{-6}

ber was prepared in a deep glass cylinder. The acid at the bottom was maintained at a uniform temperature by a water cooling coil. The samples were placed near the top of the cylinder which was externally heated with an infrared lamp. The temperature gradient prevented condensation in the upper portion of the chamber around the samples.

A series of foils was exposed in this chamber for varying periods of time and gas permeability measurements were made after each period. The cumulative exposure times for each of the three foils were 21, 40, 60, 100, and 171 hours. The foils were:

Foil	Thickness (microns)
Q–5	27.2
Q–6	28.6
Q–8	32.1

All three foils showed zero gas permeability after each exposure period, up to and including 171 hours. The surfaces of these foils were distinctly etched indicating definite surface corrosion of the nickel by the acid. However, the permeability measurements would seem to indicate that little "depth-type" corrosion occurred under these conditions, even over a considerable period of time. It would appear that some condensation is necessary to yield depth corrosion similar to that which results under outdoor atmospheric conditions.

Remodified Hydrochloric Acid Corrosion Test

C. A hydrochloric acid corrosion chamber similar to that described in paragraph A was insulated to avoid cool air currents and thereby to obtain a more uniform condensation pattern.

Six foils, initially impermeable, were exposed in the insulated chamber for measured periods of time. After each, the foils were washed and measured in the permeability apparatus. Little condensation was visible in the chamber but considerable corrosion occurred, as evidenced by green corrosion products and substantial weight loss. The results are summarized in Table V.

In this test, too, one observes erratic corrosion results. It is interesting to note that no permeability developed in several foils until more than 25 per cent of the total foil weight had been lost through corrosion. In some runs, almost half of the foil weight disappeared before porosity became evident. This raises the thought that corrosion over hydrochloric acid vapor may be quite different in character from corrosion in the atmosphere. In the latter case it is known that coatings can fail before a very substantial reduction in their thickness occurs.

Hot Water Corrosion Test

D. In order to investigate the value of hot water corrosion tests of nickel foils a water bath was set up as follows:

distilled water: pH = 5.4–5.5
temperature 95–97° C

In order to maintain uniform water conditions, the bath was made up in a closed flask and equipped with a reflux condenser so that no water additions were necessary. The foils were immersed in the hot water for measured periods of time and measured for permeability. After 64 hours, no foil had a measurable permeability. This method of corrosion was therefore abandoned.

Sulfuric Acid Corrosion Test

E. Tests were made of the corrosion of nickel foils in sulfuric acid diluted to a concentration of 10 per cent by volume. Foils S-1, 2, 3, and 4 (approximately 9 cm x 13 cm) were immersed in this acid solution for measured periods of time and photographed after each period. The weights of the foils and the number of pores photographed were recorded after each corrosion period. A summary of these data is given in Table VI.

It should be noted that under these conditions of corrosion photodetectable pores developed before a substantial loss of weight (surface corrosion) took place. For example, photographically detectable porosity developed accompanied by less than 20 mg/sq dm (approximately 0.2 micron) of surface corrosion. After the above tests were completed (11 days exposure), small foils (1.9 cm in diameter) were cut out from the remaining photographically clear areas of the badly corroded large foils, S-2 and S-4. These small foils were tested for gas permeability under atmospheric overpressure. The results follow:

Foil	k
S-2-C_{11}	0
S-4-C_{11}	3.3×10^{-7}

It is significant that a corroded foil which, on the basis of photographic inspection, has failed very badly, still has substantial clear areas whose gas permeabilities are extremely low or possibly even nonexistent. This fact reinforces the belief that corrosion of an electrodeposited coating takes place at discrete points and is certainly far from uniform over the foil. This is in agreement with the behavior of adherent nickel deposits in service.

TABLE IV. PERMEABILITIES OF FOILS CORRODED OVER 12N HYDROCHLORIC ACID FOR CUMULATIVE PERIODS

Foil	Thickness (microns)	Cumulative Corrosion Time in hours			
		0	7.5	11.5	16.5
		k (10^{-6} liter/sq cm–min)			
NN–1	29.6	<1	2	30	1000
2	27.4	<1	3000	8000	20000
3	26	<1	100	200	2000
5	28	<1	300	500	4000

TABLE V. PERMEABILITIES AND WEIGHTS OF FOILS CORRODED OVER 12N HYDROCHLORIC ACID IN AN INSULATED CHAMBER FOR CUMULATIVE PERIODS

Foil	Thickness (microns)	Initial Weight (g)	Weight Lost After 100 hr (per cent)	Weight Lost After 148 hr (per cent)	Permeability (liter/sq cm–min) After 6 hr	After 30 hr	After 54 hr	After 100 hr	After 148 hr
Q–5	27	0.062	29	37	0	0	0	0	1.8×10^{-2}*
Q–6	29	0.065	31	42	0	0	0	0	–*
Q–8	32	0.073	26	32	0	0	0	0	7.5×10^{-8}
			After 92 hr	After 140 hr	After 20 hr	After 44.5 hr	After 92.5 hr	After 140 hr	
Q–1	23	0.052	35	48†	0	0	2.7×10^{-8}	5×10^{-2}*	
QQ–3	24	0.054	24	35	0	0	0	1.8×10^{-7}	
QQ–7	23	0.053	25	34	0	0	0	9.4×10^{-8}	

*Visible hole appeared
†Crack developed; weight loss may be exaggerated

Such deposits almost always fail at discrete points which are not uniform in size or distribution.

The conclusions to be derived from these preliminary experiments are that (1) the selection of a suitable accelerated corrodant that will simulate atmospheric corrosion or a particular type of service may be difficult. (2) Since the pin-hole type of corrosion occurs nonuniformly, with unattacked areas between the pores, the use of a method like the gas permeability method which deals with only a small area, may lead to erroneous conclusions.

Accelerated Corrosion Tests Involving Immersion in Corrosive Liquids of Various Conductivities

Observations of outdoor corrosion of adherent nickel deposits and detached nickel foils indicate that pin-holing or depth corrosion is considerably more prominent than surface corrosion. It therefore appears necessary to develop accelerated corrosion tests that yield a similar relationship between depth and surface corrosion. It was observed that immersion in hydrochloric acid, which has been employed by some investigators, is not entirely suitable from this point of view. The authors' tests have shown that the deposit thickness is reduced 25–50 per cent before measurable porosity is developed by hydrochloric acid.

For purposes of comparison with hydrochloric acid several different liquid corrodants were used. Foils approximately 25 microns thick which were initially free of photodetectable pores were totally immersed in the corrodants. After each corrosion period the foils were washed, dried, weighed, and rephotographed. The four corrodants used were:

TABLE VI. PHOTOGRAPHICALLY DETECTED PORES SPOT COUNT AND CUMULATIVE WEIGHT LOSS OF FOILS CORRODED IN AQUEOUS SOLUTION OF SULFURIC ACID

Days Corroded in 10 per cent by vol H_2SO_4	Foil S–1 23.5 Microns Thick		S–2 24.4 Microns Thick		S–3 23.2 Microns Thick		S–4 22.0 Microns Thick	
	Spot Count	Cum Wt Loss	Spot Count	Cum Wt Loss	Spot Count	Cum Wt Loss	Spot Count	Cum Wt Loss
		mg/sq dm		mg/sq dm		mg/sq dm		mg/sq dm
0	0	—	0	—	0	—	0	—
1	1	18.5	2	13.5	4	14	5	17.5
2	7	33	13	26	8	30	6	39.5
3	12	46	50	59*	23	66.5*	6	63
4	31	66.5	50	79.5	29	96.5	12	102
5	63	91	60	96.5	32	119	12	137
6	84	108	60	110	44	134	19	160
7	125	125	75	123	60	151	32	182
10	255	155	165	153	170	187	70	215
11		168		165		204		230

*Edge corrosion due to drop in acid level. Abnormal weight loss.

TABLE VII. RATE OF CORROSION OF WATTS' NICKEL DEPOSITS IN LIQUID CORRODANTS

Corrodant	Rate of Corrosion (mg/sq dm/day)
2N sulfuric acid	17
1N hydrochloric acid	86
0.5N sodium chloride	<0.1
2N acetic acid	10

2N sulfuric acid
1N hydrochloric acid
0.5N sodium chloride
2N acetic acid

The approximate rates of corrosion of Watts' nickel deposits by the above four corrodants are listed in Table VII and illustrated in Fig. 7.

The conclusions derived from this test can be summarized as follows:

(a) Hydrochloric acid causes the most rapid rate of surface corrosion (determined by weight loss) but rather slight depth corrosion (determined by photographs).

(b) Acetic acid results in slight surface corrosion but *extreme* depth corrosion.

(c) Sulfuric acid is intermediate between (a) and (b).

(d) Salt solution results in extremely little depth or surface corrosion.

The somewhat surprising action of acetic acid led to the suspicion that the conductivity of the corrodant was related to its tendency to cause depth type corrosion. It can be reasoned that, with a relatively poor electrolytic conductor, galvanic cells which are set up tend to be localized. Only anodic areas near a particular cathodic area will be corroded, i.e., depth corrosion results. Where the corrodant is a good conductor the galvanic cells spread their effect and more or less uniform surface type corrosion takes place. Acetic acid is only slightly dissociated and therefore is a poor conductor. If the above postulation is correct it should be possible to increase the conductivity of a weak acid (without appreciably changing its *p*H) and thereby reduce its effectiveness in depth corrosion.

A 2N acetic acid solution was made up and split into four parts. To one part was added a small amount of salt (NaCl); to a second a greater amount of salt was added; to a third some sodium acetate was added. The conductivity and *p*H of each solution was measured. Four nickel foils (approximately 25 microns thick, previously photographed and weighed) were immersed, one in each solution. After *8 hours of exposure* the foils were removed, washed, reweighed, and rephotographed. The results follow in Table VIII and Fig. 8.

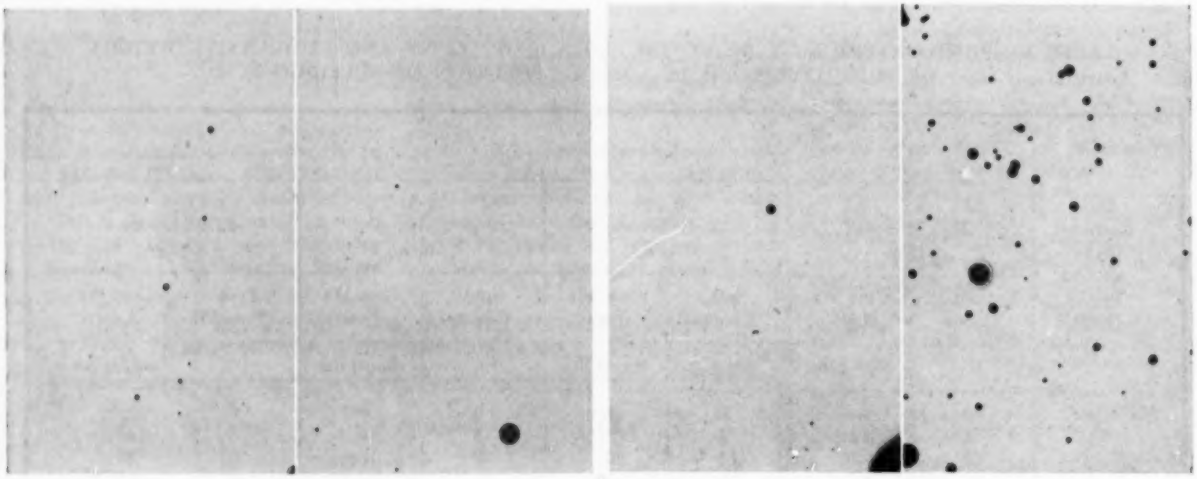
An additional series of corrosion runs was made using formic and butyric acids. Qualitatively, their effect was similar to that described above for acetic acid.

The results of the above tests tend to confirm the belief that depth type corrosion and the conductivity of the corrodant are closely related. Where the conductivity was increased the extent of depth corrosion decreased. On the other hand an increase in conductivity resulted in a greater weight loss. These changes show that depth corrosion *only* was inhibited whereas total corrosion actually increased. The possibility that the introduction of chloride ions to the corrodant was the dominant factor can be discounted because the introduction of sodium acetate yielded the same result. The fact that formic and butyric acids also result in exceptional depth corrosion indicates that the behavior is not specific for acetic acid.

The relation between corrodant conductivity and the nature of the resultant corrosion is a phenomenon which could bear further investigation. It could conceivably explain some of the peculiarities which are frequently observed in corrosion. In any case, it might serve as an approach in the search for accelerated corrosion media. It is probably possible to vary the conductivity of the corrodant and thereby simulate specific corrosion exhibited by outdoor exposure.

Relation Between the Porosity of Detached and Adherent Electrodeposits

One of the major drawbacks of working with detached electrodeposits is the current inability to relate them to the usual adherent deposits employed in



(a) (b) (c) (d)

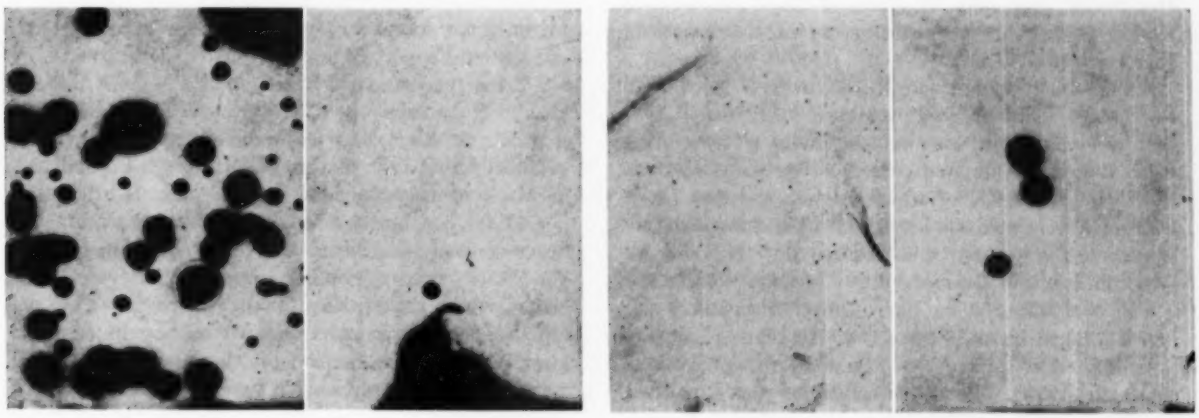
Fig. 7. Photodetectable porosities of Watts' nickel foils corroded in different liquid corrodants

Corrodant	*Time (days)*	*Weight Loss (per cent)*	*Corrodant*	*Time (days)*	*Weight Loss (per cent)*
a 2N sulfuric acid	*11.7*	*18*	*c 0.5N sodium chloride*	*17*	*0.1*
b 1N hydrochloric acid	*2.75*	*19*	*d 2N acetic acid*	*0.5*	*0.5*

TABLE VIII. WEIGHT LOSSES OF FOILS CORRODED IN ACETIC ACID SOLUTIONS OF DIFFERENT CONDUCTIVITIES FOR 8 HOURS

Solvent	Addition			Solution Cond. at 29° C (ohm^{-1}/cm)	Solution *p*H	Foil (surf. area 115 sq cm)	Weight			Corrosion Rate (mg/sq dm/day)
	Solute	Normality	g/100 ml				Initial (g)	Final (g)	Loss (g)	
2N acetic acid	none	—	—	0.0023	2.15	AC–71	1.316	1.313	0.003	8
2N acetic acid	sodium chloride	0.04	0.25	0.0072	2.15	AC–81	1.324	1.314	0.010	26
2N acetic acid	sodium chloride	0.7	4.0	0.064	2.05	AC–72	1.286	1.278	0.008	21
2N acetic acid	sodium acetate	1.2	10.0	0.040	4.2	AC–82	1.410	1.402	0.008	21

service. There is, as yet, no assurance that the properties of coatings deposited so as to be nonadherent are the same as those deposited adherently. On the other hand, if a coating is deposited adherently and then detached by chemical stripping of the base, there exists the danger that additional porosity is induced in the coating by the stripping operation. Preliminary work has been done to detect directly the porosity of intact adherent coatings through the use of radioactivity. This procedure involves the deposition of a thin radioactive coating on the basis metal and the subsequent deposition of a regular coating over the radioactive layer. Autoradiographs would then be made in the hope that pores in the upper coating would appear on film as spots similar to those now resulting from conventional photographs made of detachable coatings. If the radioactive approach proves fruitful it will permit tracing the progress of pore formation during corrosion of adherent deposits. The radioactive approach cannot be expected to find general applicability but it may be useful as a research tool. It may relate adherent and nonadherent deposits and thereby assess the validity of tests on detached foils.



(a) (b) (c) (d)

Fig. 8. Photodetectable porosities of Watts' nickel foils corroded in acetic acid solutions of different conductivities for 8 hours

	Corrodant	Conductivity	*p*H
a	*2N acetic acid*	*0.0023*	*2.15*
b	*2N acetic acid + 0.04N sodium chloride*	*0.0070*	*2.15*
c	*2N acetic acid + 0.7N sodium chloride*	*0.064*	*2.05*
d	*2N acetic acid + 1.2N sodium acetate*	*0.040*	*4.2*

GEORGE B. HOGABOOM

The American Electroplaters' Society's first President, Founder and Honorary Member, died at the age of 79 on the last day of 1953.

A descendant of early Dutch settlers, he was born in Brooklyn, N. Y., attended schools in the metropolitan area and was graduated from Newark Technical Institute in 1910. He worked in various supervisory capacities in the plating departments of the International Silver Company, P & F Corbin Division of the American Hardware Corporation, served with the Hanson-Van Winkle-Munning Company, and also acted as a consultant. Mr. Hogaboom served the government as a technical advisor during both World Wars. In addition to his AES affiliation, which included membership in both the Hartford and Newark Branches, he was a member of the American Chemical Society, ASTM, and the Electrodepositors' Technical Society of England.

The book, "Principles of Electroplating and Electroforming," written in collaboration with Dr. Blum, is outstanding among his numerous contributions to the literature of the industry.

Mr. Hogaboom is survived by his wife and three children: G. Byron, Jr. of Kenilworth, N. J.; Ovide of Newington, Conn., and Mrs. Charles Crockett of Manchester, Conn. He will be sadly missed by family, friends and members of the Society which he helped make so great.

In further tribute to him the following words by two of his close friends are also published.

George B. Hogaboom—Pioneer of Modern Electroplating

A Tribute from His Friend and Associate, William Blum

The names of "Blum and Hogaboom" have been so closely associated through our joint textbook that the title of the book has become secondary. It is therefore appropriate that at this time I should recall and recount some of my personal contacts with George Hogaboom, especially as many of these are so intimately connected with the history of the American Electroplaters' Society.

I first met George Hogaboom at the third AES convention, held at Dayton, Ohio, in 1915. It was then obvious to me, a newcomer in the electroplating field, that he dominated many of the plans and activities of the AES, of which he was the first president. He welcomed me into the field and immediately started to discuss how the National Bureau of Standards could join in the aims of the Society.

The next occasion for our intimate association was in 1918, when he and others from the plating industry were invited to a conference on military applications of electroplating. Soon thereafter he was appointed as "Electroplating Advisor" to the National Bureau of Standards. Together with Fred (Dad) Liscomb, and Tom Slattery, he brought to us scientists a grasp of practical plating which would otherwise have taken many years to acquire. During this period Hogaboom, Liscomb and Slattery lived in our home, so we talked electroplating most of our waking hours!

In 1920 I was requested to write a book on electroplating, and, recognizing the need for presenting both the practical and theoretical sides, I asked George Hogaboom to be a coauthor. At first he demurred, probably because he was not yet convinced that a scientist could contribute much to this field. After further consideration he agreed and in 1924 the first edition of Blum and Hogaboom appeared. The practical information and formulas supplied by him were especially valuable in this edition, because otherwise I might have found myself explaining processes that did not exist!

During the interval between World Wars I and II, George Hogaboom was active in connection with NBS plating researches, first as a member of an advisory committee and later of the AES Research Committee, of which he was chairman for one year. During this period he constantly brought up new problems for research, some of which were then, and still are, beyond the scope of existing knowledge and methods. His views at times seemed contradictory, because on the one hand he wanted research to be expedited to meet immediate needs, and on the other hand he demanded that every research should be complete and conclusive.

During World War II he was associated with the War Production Board, with special reference to the conservation of metals such as copper and nickel, and the development of substitutes for these metals in plated coatings on both military and civilian supplies. I sat in with him and others in many conferences on this subject. Just as with the nickel shortage of the last few years, he was very critical of substitutes that he felt were unsatisfactory and not creditable to the plating industry.

In a very real sense, George Hogaboom was a perfectionist, and hence was critical of all researches and results that fell short of perfection (as all must). Even when others, including myself, felt that some of his criticisms were unwarranted, close scrutiny usually showed that improvements were possible in the report or the method, though not necessarily in the way suggested by him. At one of the Research Committee meetings, in his presence, I stated that "I am always glad to hear George Hogaboom's criticisms, for I am sure that he will think of everything that any one would suggest, hence I need not worry about criticisms from others." Such a person with the determination to fight for his views serves a very useful purpose in any field such as plating, because he forces people to re-examine their assumptions and conclusions, and thus frequently brings about definite improvements.

George Hogaboom represented in the best sense a combination of a vast fund of practical experience and as much science as a person can acquire without the opportunity for a formal scientific education. In recent years he regretted his inability to fully understand the mathematics and advanced physics and chemistry that are now involved in many researches in electrodeposition. I assured him sincerely that he should not worry about that limitation, as most scientists have difficulty in understanding and using the results of the revolutionary researches of the last twenty-five years.

Electroplating was the very life of George Hogaboom and the AES was its living symbol. Even though he was a member of the Electrochemical Society and the ASTM, he was very jealous lest these bodies usurp any of the prerogatives of the AES, a fear that I am sure was unfounded. He was a zealot and a crusader for advancement in our knowledge of plating. Through his persistence he awakened many of us from our complacency or even apathy regarding progress. His life work built a bridge between the art and the science of electroplating, the influence of which will be felt for generations. He was literally a pioneer in this difficult and important field. In his last letter to me he regretted, in fact resented, his inability to continue the strenuous activities that he had conducted for over sixty years.

His work is finished, it is our task to complete it.

A Eulogy on George B. Hogaboom

By Royal F. Clarke, Sr.

As a personal friend of George Hogaboom for 44 years, I feel it my duty to eulogize him. It was at the first meeting of electroplaters at the Broadway Central Hotel in February 1909, prior to the formation of the old National Electroplaters' Association of the U. S. and Canada, that I first met George Hogaboom. Our friendship has continued until his death on December 31, 1953. During those 44 years, we had corresponded often after we both had left Newark and exchanged Christmas cards yearly. I received his last card on December 23, 1953.

George had a very extensive library of books on electroplating. One he prized especially was on "Gold Plating" by Roesleur and printed in French.

I recall that George had a tiny hippocampus, a small fish which swims upright and has a head and foreparts horse like in form (called a sea horse by Webster). George metalized it in copper then silver plated it and used it as a watch charm.

In 1916, George and I attended the Bridgeport, Conn., banquet and took the midnight trolley to my home in East Norwalk. That night it only went to Westport. Since it was a beautiful moonlight night, we walked 3 miles to my home and talked "plating" all the way.

When George was employed in Newark, in a plant where silver was deposited on glass articles such as perfume bottles, small sugar bowls and cream pitchers, I was taken through the plating department. I was shown wires which were wound around the articles that had 36 to 48 hours of silver plate. George tied a wire into a knot showing the softness of the silver deposit and no peeling occurred. It was at this plant that windows were left open one night when the winter temperature dropped to zero. Next morning, George noticed that crystals were adhering to the sides of the silver plating tanks and on the bottom. He siphoned the silver electrolyte and shoveled the precipitate out and had the crystals analyzed by our honorary member, Dr. Joseph W. Richards, Professor at Lehigh University, who reported the crystals were carbonates. That was, I believe, the beginning of "freezing out of carbonates" from cyanide plating electrolytes. George told me that after the freezing he discovered that he did not need to add as much free cyanide as formerly.

George gave freely of his knowledge on the deposition of metals. His passing will be missed by the entire membership of the American Electroplaters' Society.

George and I were, until his untimely death, the only two platers living that attended the first meeting in 1909, prior to the formation of the American Electroplaters' Society.

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Book Review

DR. HAROLD J. READ
Professor of Metallurgy, The Pennsylvania State University

PROPERTIES OF METALLIC SURFACES, a symposium organized by the Institute of Metals, 368 pages, 1953. The Institute of Metals, 4 Grosvenor Gardens, London, S.W. 1, England. Price, $5.50.

This collection of thirteen papers represents a wide diversity of specific subject matter within the general field of the properties of metallic surfaces. Some are review articles, others present new research data and a few contain new material along with extensive discussions of earlier work on the same subject. All of the contributions are of outstanding quality, and it is particularly gratifying to find that the review papers are for the most part extremely critical.

A few of the papers are not of direct interest to metal finishers, e.g., those upon the effects of surface conditions on the mechanical properties of single crystals or on the strength of brittle materials. Even these, however, may be of interest because of their general bearing on surface properties. Most of the papers bear intimately on the problmes of the metal finisher or are closely associated with them. It should be made clear, however, that none of the papers deals with the practical problems of metal finishing, rather they are all concerned with problems which arise from the reactions which occur at metallic surfaces or with the physical and mechanical effects associated with such surfaces.

It is not practical to review each of the papers of interest to metal finishers, but a brief discussion of one or two of them may indicate the general nature of the volume.

The chapter on diffusion coatings deals systematically with a subject which, though old in some applications, is of much current interest for possible new applications. The discussion summarizes the mechanisms which have been suggested for the production of diffusion coatings and many indications are given of how such problems can be attacked by a scientific rather than an empirical approach. The corrosion behavior of metallic surfaces is well known to be influenced by the surface condition of the metal. The present state of knowledge in this field has been well summarized in a concise chapter. In addition to the information presented, the article emphasizes the need for additional work and to some extent points the way in which profitable investigations could be undertaken.

The book is well printed with excellent illustrations, and no fault can be found with the editing, save in one respect. The discussions of all the papers have been collected at the end of the book, requiring the reader to search out the discussion which pertains to a particular chapter in which he may be interested.

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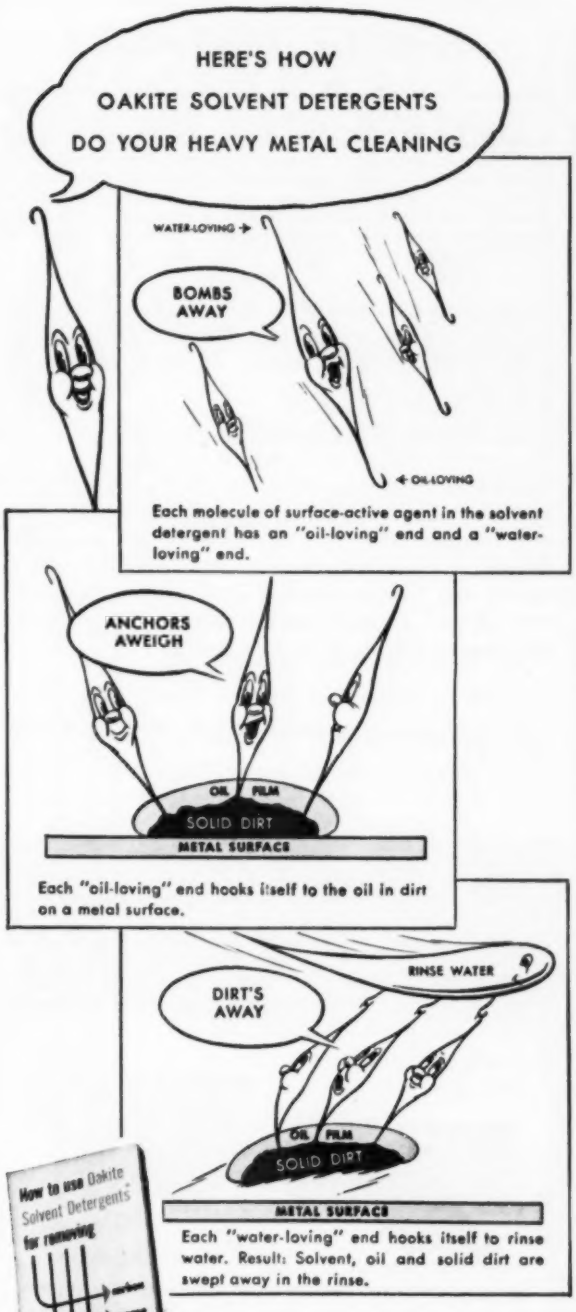
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Article Abstracts

No copies of articles are available at the offices of "Plating". Photostats may be had from libraries having files of the journal in question and offering photostat service, usually at 30-50 cents a page. Ask your public library to consult the Union List for names of libraries having the particular journal. Abbreviations used are those of Chemical Abstracts.

Polarization Studies of Copper, Nickel, Titanium, and Some Copper and Nickel Alloys in Salt Solutions*. H. B. Bomberger, F. H. Beck, and M. G. Fontana.

Polarization characteristics were determined for some metals and alloys in flowing salt solutions. Relationships between potential and time, potential and applied current, applied current and corrosion rate, and solution velocity and corrosion rate were considered. Copper and brass anodes dissolved readily. Nickel and copper-nickel alloys exhibited in anodic overvoltage. Titanium anodes resisted dissolution by film growth and extensive polarization.

*Presented at the Electrochemical Society meeting at Wrightsville Beach, N. C. (1953).

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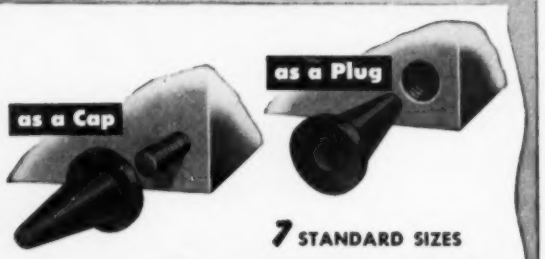

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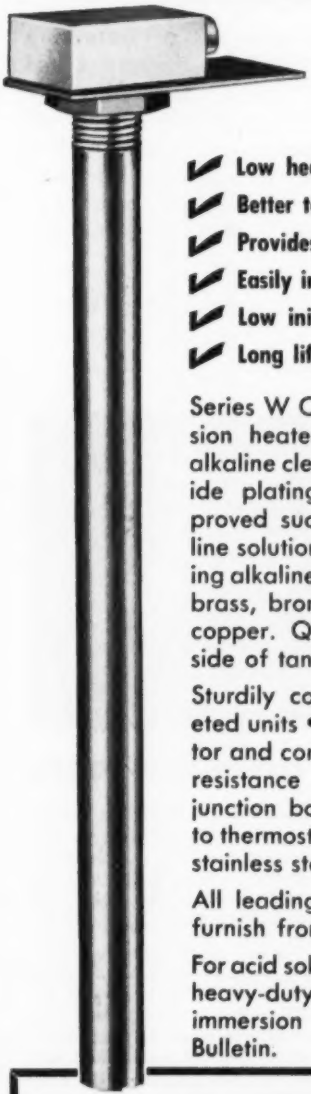

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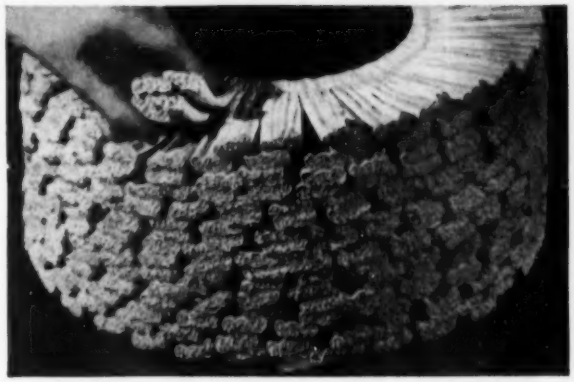

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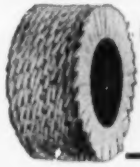

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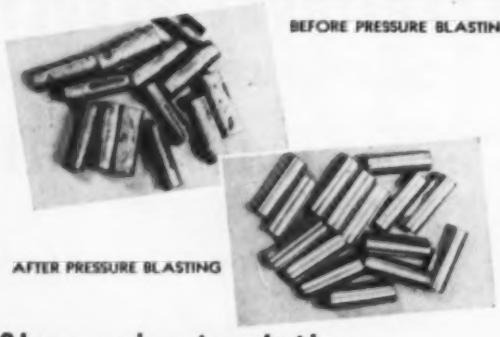

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Article Abstracts

Electronic Configuration in Electrodeposition from Aqueous Solutions. II. The Deposition Process*. Ernest H. Lyons, Jr.

It is proposed that electrodeposition proceeds through an intermediate complex ion adsorbed on the cathode by a coordinated bridge. Subsequently, the bridge is eliminated and a metallic bond established. By applying the Pauling theory of the metallic state, the reversible deposition of post-transition metals and irreversible deposition of the transition metals are explained. A close correlation with electron-transfer reactions is shown. Inclusions in deposits represent residual coordinated groups, in agreement with the results of recent studies.

Electrodeposition of a Lead-Tin Alloy Containing Six Per Cent Tin*. William S. Fischgrund and Charles L. Mantell.

The most stable solution for depositing a six per cent tin deposit has the following composition: 0.11N stannous tin; 0.89N lead metal; and 0.5 g/l peptone. This solution can be operated at room temperatures, and current densities from 10 to 45 asf are permissible.

*Presented at the Electrochemical Society meeting at Wrightsville Beach, N. C. (1953).

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Patent Abstracts

GEORGE B. HOGABOOM

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

No. 2,653,128, September 22, 1953—Method of and Bath for Electrodepositing Tungsten Alloys—Abner Brenner and Polly S. Burkhead and Clara A. Sentel, assignors to United States Government as represented by the Secretary of War.

Broadly stated, a principal object of our invention is to provide a simple, direct and highly efficient method for electrodepositing alloys of tungsten with one or more metals of the iron group. . . .

The ions of the single alloying metal (iron, nickel or cobalt), or the ions of two or more of such metals to be co-plated with tungsten are supplied by introducing in the bath a soluble salt of the particular metal involved.

. . . . The aliphatic organic ions which make up a part of our novel electrolytic bath are supplied in the form of a soluble salt or salts of an hydroxy carboxylic acid such as citric, tartaric, malic, gluconic or the like, of which the OH and COOH groups amount to three or more in the sum total, and the cations neither produce insoluble precipitates with all other constituents of the bath nor do they react at the cathode. Salts of any of these hydroxy carboxylic acids which are suitable include those of potassium, sodium, ammonium, etc. . . .

NOTE: Nickel-tungsten alloy bath—consisting of the following constituents: 26 grams/liter nickel chloride ($NiCl_2.6H_2O$); 70 grams/liter sodium tungstate ($Na_2WO_4.2H_2O$); 100 grams/liter sodium citrate and the remainder water.

Cobalt-tungsten alloy bath—70 grams/liter sodium tungstate; 28 grams/liter cobalt chloride; 100 grams/liter Rochelle salts; 50 grams/liter ammonium chloride. Current density 1–3 amperes per square decimeter; *p*H 8 to 9; temperature 80° to 95° C.

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like the present" to improve your knowledge of modern electroplating techniques. You can gain this knowledge easily and pleasantly through my unique home study course. Once gained you'll profit continuously from it. Write for the facts today. No obligation. Joseph B. Kushner, Electroplating School, 115 Broad St., Stroudsburg 120P, Pa.

Iron-tungsten alloy bath—70 grams sodium tungstate; 8 grams iron in form of sulfate or chloride; 10 grams sodium citrate; 50 grams ammonium chloride per liter. Current density 2–5 amperes per square decimeter; *p*H 8–9; temperature 90° C.

These deposits range in tungsten content of approximately 1 to 40 per cent for nickel-tungsten; up to 55 per cent for the cobalt alloy, and up to 65 per cent for the iron alloy.

CLAIM 1. The method of electroplating a metal object with an alloy composed of tungsten and at least one metal of the group consisting of iron, cobalt and nickel; which method comprises connecting the object to be plated as a cathode in an electrolytic bath consisting of an aqueous alkaline solution of soluble salts that supply to said solution tungstate ions and a complex consisting of ammonium ions plus ions of at least one metal of the group consisting of iron, cobalt and nickel, plus aliphatic organic ions having at least three hydroxyl and carboxyl groups in sum total, said soluble salts being substantially nonreactive chemically with said metal object upon which the tungsten alloy is being electroplated, and plating said metal object with the tungsten alloy.

12 claims.

References cited: U. S. Patents 2,160,321; 3,160,322. British Patent 460,931. Yntema, Journal American Chemical Society, Vol. 54, (1932), pp. 3775–3776. Fink et al, Transactions, Electrochemical Society, Vol. 59 (1931), pp. 461–481. Vaaler et al, Transactions Electrochemical Society, Vol. 90 (1947), pp. 43–54. Golz et al, Journal Applied Chemistry (U.S.S.R.), Vol. 9 (1936), 640; Chemical Abstracts, Vol. 30 (1936), p. 7460. Belyaer et al, Korrozinya i Borba s Nei, Vol. 6, No. 2 (1940), p. 47; Chemical Abstracts, Vol. 36 (1942), p. 3735.

No. 2,654,701, October 6, 1953—Plating Aluminum—E. R. Calderon and G. W. Slomin, Los Angeles, Calif.

CLAIM 5. A method of providing objects, composed essentially of aluminum, with a tenaciously adherent, fine grained alloy plating, comprising etching the degreased surface of objects composed essentially of

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aluminum with an aqueous solution of alkali hydroxide and alkali fluoride at a temperature between 125° F and 145° F said solution containing from about 0.75 oz to 4 oz of sodium fluoride per gallon, and rinsing the etched surface; then treating the surface with diluted nitric acid and rinsing the surface; then forming a thin, adherent film of zinc on such treated surface by immersion in an aqueous, alkaline solution of potassium zincate containing a solution depressant for silicon and copper, and a surface tension depressant, at a temperature of about 80° F and 105° F; rinsing the activated surface and electroplating the activated surface in an aqueous strike solution containing cyanides of copper, zinc and a metal from the group consisting of silver, gold and indium, said strike having a *p*H between 9 and 10 and a surface tension below 45 dynes per square centimeter.

16 claims, 1 figure—operation cycle.

References cited: U. S. Patent 1,104,842; 1,627,900; 1,923,790; 1,938,961; 1,943,853; 1,954,353; 2,142,564; 2,151,302; 2,496,845; 2,501,737; 2,513,365. Metal Finishing, August, 1940, p. 435.

No. 2,654,702, October 6, 1953—Electrodeposition of Metal from Alkali Cyanide Baths—Herbert K. De Long, assignor to Dow Chemical Co., Midland, Mich.

CLAIM 1. In a method of depositing an electroplate of a metal selected from the group of copper, silver and gold upon articles of magnesium alloys from an aqueous alkaline cyanide plating solution having a *p*H of 9 to 13 and containing a cyanide of one of the metals selected from the group consisting of copper, silver and gold and from 2 to 5 grams per liter of CN provided an alkali metal cyanide by electrolyzing the solution with the article as cathode whereby the selected metal is electrodeposited on the article, the improvement which consists in dissolving in the plating solution a water-soluble inorganic fluoride selected from the group consisting of the alkali metal and ammonium fluorides in amount from 5 to 100 grams per liter of the plating solution.

8 claims, 6 examples (copper, silver and gold plating baths).

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  bright, ductile deposits are obtained at high current densities.
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No. 2,655,473, October 13, 1953—Electrolytic Detinning—F. A. Lowenheim, assignor to Metal & Thermit Corporation.

CLAIM 3. Method for recovering tin from tin scrap which comprises suspending the scrap in a bath of an aqueous caustic alkali solution having an insoluble anode disposed below the scrap and a cathode above the scrap, passing an electric current through the bath from the anode to the cathode and intermediately through the solution and through the scrap, thereby generating oxygen gas at the anode for upward passage through and in intimate contact with the scrap to dissolve the tin and to form an anolyte solution in the vicinity of the anode, continuously removing the anolyte solution from the bath, separating from the anolyte solution impurities originally introduced to the bath with the scrap, then returning the anolyte solution to the bath in the vicinity of the cathode, plating the tin content of said latter solution upon a cathode by means of said current and thus forming a catholyte solution in the vicinity of said cathode having a decreased tin content, and continuously passing said catholyte solution to the vicinity of the anode to replace anolyte solution removed therefrom.

3 claims, 4 figures.

References cited: U. S. Patents 704,675; 907,061; 1,511,967; 1,983,296; 2,196,355; 2,200,782; 2,243,165; 2,350,669. British Patent 327,997.

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A. E. S. INTERIM MEETING, ROYAL YORK HOTEL, Toronto, Ontario, February 13, 1954.

Delegates should make their own hotel reservations.

Branch News

Coming Events

DAYTON BRANCH
NINTH ANNUAL EDUCATIONAL SESSION AND DINNER-DANCE
Saturday, February 27, 1954
at the Biltmore Hotel
Educational Session at 1:30 P. M.

PAPERS AND SPEAKERS

A. R. BURMAN, Cro-Plate Co., Inc., Hartford, Conn., "Pressure Wet Blasting"
R. O. HULL, R. O. Hull & Co., Inc., Rocky River, Ohio, Subject to be announced
Third Speaker to be announced

BALTIMORE-WASHINGTON

December 8, at 8:00 P. M., the Branch held a meeting at the National Bureau of Standards, Washington, D. C.

This meeting consisted of a very short order of business followed by a very informative talk about the Kanigen Process by RICHARD W. LANDON. Landon displayed samples to show how this process could be used to do a better job, under certain conditions, than that normally accomplished by electroplating.

CARL THIEDE, *Secretary*

BRIDGEPORT BRANCH

On December 12, in the famous "Winter Quarters" of the Hotel Barnum the branch held its traditional Christmas dinner-dance. More than 100 members and guests including many from other branches were in attendance. The ball was started rolling by the serving of an excellent dinner featuring roast Vermont turkey with all the trimmings. Needless to say, the "cup that cheers" was prominent on all the tables.

The melodic strains of Bob Weller's fine orchestra serenaded the party during dinner and later provided the inspiration for "the bunny hop" and for individual attempts at the art of walking the floor. One of the high lights of the evening was a visit from Santa Claus and his helpers. Santa supervised the distribution of the gifts to the deserving "children" present. Door prizes donated by various members of the selling fraternity and employers of members were most enthusiastically received. Among the donors were BOB CREAMER of Hanson-Van Winkle-Munning; AL FERGUSON of MacDermid Inc.; BILL GILLETTE of Baker Bros.; HENRY STROW of Tru-Brite; RAY GORAL of Enthone. Another high light, donated by ART MACNEIL of MacDermid, Inc., was the New York type floor show. It met with enthusiastic approval and was augmented by the heretofore undisclosed talents of LARRY BENNETT. The great majority of guests voiced their delight and claim that Larry is ready for big time. At 1 o'clock to the tune of "Home Sweet Home" the happy guests started to trek homewards.

BOB PARKER, *Secretary-Treasurer*

CHICAGO BRANCH

About 50 members turned out on December 11, to hear DR. F. E. VAN ATTA, Director of Industrial Hygiene, National Safety Council, discuss safety in the plating room. As is usual at Chicago Branch, the business meeting and cocktail "mixer" preceded the dinner, and educational session.

At the business meeting, after reports from the chairmen of the various active committees, a letter from National Headquarters requesting back issues of PLATING magazine was read.

Also heard at the business meeting, good news for prospective new members, a great deal of thought is now being given to a plan for a sponsor method of getting new members acquainted in the branch. The new method will also make participation in branch activities easier and more interesting for new members.

Unfortunately, Dr. Van Atta's plane was late and he was unable to have dinner with the assembled members.

Since the speaker's primary interest is the public health aspects of the plating room hazards, his talk concerned itself primarily with the effects of finishing operations on the health of those either performing them or performing near them.

Both buffing and polishing, he points out, are inherently hazardous to health because of the amounts of various dusts produced; however, the hazard can be eliminated by the use of well-designed ventilating and dust collecting equipment.

Cleaning and degreasing do not present many health problems unless shop ventilation is extremely poor. Degreasing, too, creates few problems except where equipment is either poorly designed or located.

With direct reference to plating, Dr. Van Atta told the group that chromium plating presents by far the greatest health hazard. In spite of this, adequate ventilation and proper use of protective clothing can combine to reduce this hazard to a minimum.

The speaker also discussed some forms of dermatitis likely to occur around the plating room, for example, nickel itch. Generally most of these conditions can be readily controlled by avoiding all contact with the irritating solution.

After his talk, Dr. Van Atta discussed many specific questions put to him from the floor.

Last, but certainly far from the least, the Chicago Branch cordially welcomes the following new members to the Branch: JOSEPH J. SCHAEFFER of the Udylite Corporation, ALBERT BENJAMIN of Clinton Supply, and JAMES J. PERRY and E. D. FONTAINE of Mitchell De-Burring. Glad to have you aboard.

JEROME KUDERNA,
Publicity Representative

CINCINNATI BRANCH

The meeting was called to order by ACTING PRESIDENT WILLIAM D. GORDON with 29 members and guests present.

The minutes of the October and November meetings were read and approved.

W. LOVELESS, as chairman of tri-state educational session and dinner-dance, gave a report on the progress of the committee to date and asked for the cooperation of the Society as a whole.

Gordon introduced JOHN A. SWIFT, Swift Industrial Chemical Company, Canton, Conn., who gave a very entertaining and informative talk on the manufacture of steel and what factors affect plating. His talk included the composition of steel, methods of making steel, general terms applied to steel, methods of specifying steel and lubricants used in rolling of steel. His talk was augmented with slides and was followed by an interesting question session.

The meeting adjourned at 10:00 P. M. and everyone retired to the dining room to enjoy a social hour—the courtesy of Products Finishing.

WILLIAM YOUNG, *Secretary*

DALLAS-FORT WORTH BRANCH

A regular meeting was held on December 16 at the Lennox Hotel, Grand Prairie, Texas. One visitor, K. W. PORTER of Bell Aircraft Corporation, and one new member, JIM LOUIS, were present with the 25 members at dinner and the technical session.

The business session was a very active one. JIM WEAVER was appointed chair-

man of the entertainment committee by PRESIDENT ZITO. Approval was given by the branch to extend an invitation to American Society of Metals and Corrosion Engineers for a joint meeting with the branch in either February or April, when we will have speakers from Aluminum Company of America and International Nickel Company.

Speaker for the evening was AES SECOND VICE-PRESIDENT CLYDE KELLY from Chicago who had a very timely message for the branch. He discussed very carefully and in detail the work of the Job Plater Owners' Association in Chicago, giving the advantages of such an organization and an outline of how such an association should be organized and function. The research program of AES was discussed before the meeting. Of interest to the group was the corrosion test being conducted in Detroit jointly by AES and the automotive companies to help establish a new type corrosion test. The work of the AES was discussed and changes in PLATING were brought to our attention. Mr. Kelly said that we should avail ourselves of all the publicity which we can obtain, that we should work very closely with the Chamber of Commerce to be sure that information is available through that body to establish the functions of job platers and to give a complete brochure of their capacities.

A very lively discussion followed the talk. Refreshments were furnished, compliments of Van Waters and Rogers Inc.

R. H. HEPPEL, *Publicity*

DAYTON BRANCH

On December 4, 25 members and guests of the branch met at Suttmiller's for a buffet supper and stag party. All those present joined in card playing and refreshments. With JOHN GUSS accompanying at the piano, everyone had an opportunity to display their vocal talents.

RAY COY, social chairman, has announced the following committee for handling the ninth annual educational session and dinner-dance on February 27, 1954:

Educational Session, HOLLE LUECHAUER

Program and Advertising, RICHARD WAYMIRE

Hotel Arrangements, RALPH COLLINS

Entertainment, FRANK KLIEN

Tickets and Reservations, ROBERT RULEFF

Favors, JACK BAKER

Publicity, JOHN EASTON

The branch is happy to welcome EARL D. CREESE of Moraine Products Div. GMC, who recently transferred from the Cincinnati Branch.

JOHN EASTON, *Secretary*

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DETROIT BRANCH

The annual technical session was held December 4 in the Wayne Room at the Statler Hotel. Approximately 200 members and guests were present.

PRESIDENT L. C. BORCHERT opened the meeting at 8:10 P. M. with the introduction of the following guests: DR. GEORGE SWIFT, AES President; CLYDE KELLY, AES 2nd Vice-President, and P. PETER KOVATIS, AES Executive Secretary. Next, JOE GURSKI, 1st Vice-President, and LEE MORSE, 2nd Vice-President, branch officers, were introduced.

President Brochert then turned the meeting over to EDUCATIONAL CHAIRMAN FRED OLMSTEAD, who, in turn, presented the honorary chairman for the session, DR. WILLIAM BLUM.

Dr. Blum gave a talk illustrated with color slides on his recent trip to Australia with Mrs. Blum.

Dr. Blum then introduced the first guest speaker of the evening, DR. E. J. SERFASS, Lehigh University, who discussed "Recent Developments in the AES Research Program." Dr. Serfass outlined the work of the various Project groups and cited their reports that have been and will be published in PLATING. He added that a "Process Control Handbook" based on Project 2 activity is being prepared and should be published within 18 months.

Dr. Blum next introduced the second guest speaker, WALTER PINNER, Houdaille-Hershey Corp., who spoke on Project 15, "Study of New Accelerated Corrosion Tests." His paper on this very active Project was similar to that presented by him at Philadelphia, and published in the December issue of PLATING. Results of this Project can be more

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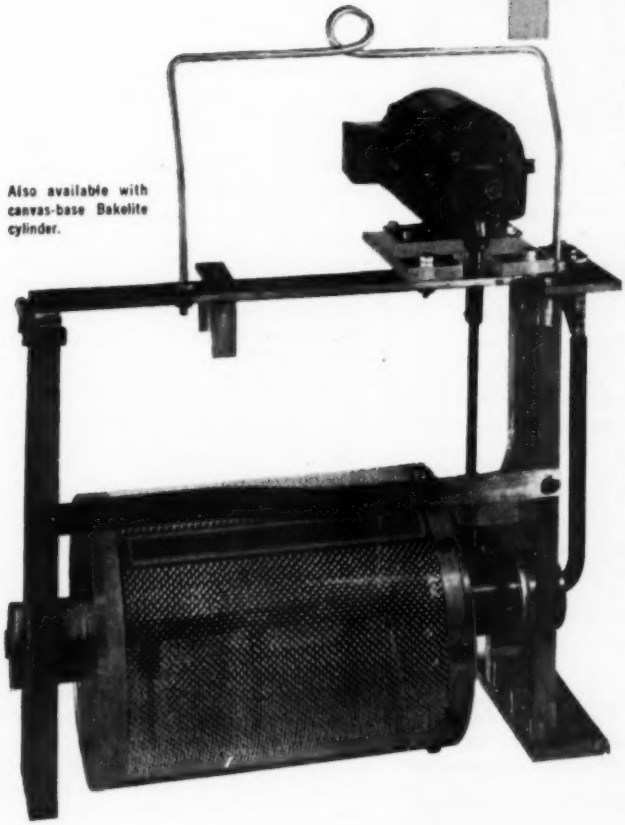

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Branch News

nearly determined in the spring when sample plated panels will be collected and evaluated after a long winter's exposure.

Dr. Blum then introduced the last guest speaker of the evening, Dr. A. E. R. Westman, Ontario Research Foundation, who discussed a report from Project 14, similar to his presentation at Philadelphia which was published in the December issue of Plating.

A question and answer period followed in which all speakers acted as a panel.

Prior to adjournment, 2nd Vice-President Lee Morse presented the research costs of the various Project committees to the meeting. Approximately $65,000 per year is spent on research.

On the speakers' platform, a board listed the many companies that have contributed toward the research projects.

The meeting was adjourned at 10:15 P. M. and friendship continued with the serving of refreshments.

To climax this excellent meeting, the annual Christmas Party was held on the following day in the Statler Hotel with over 1600 members and guests attending. An exceptional program was provided, headed up by Program Chairman Howard McAleer.

John C. Drinkwater,
Publicity Chairman

HARTFORD BRANCH

As has been the custom in the past several years, the branch did not have its regularly scheduled educational meeting. In its place, the annual Ladies' Night and Christmas Party was held on December 15.

About 104 people were present at the Nutmegger House in Newington to enjoy a hot buffet dinner (Smorgasbord style) and the usual liquid refreshments were served.

Harry Sanders, Chairman of the Entertainment Committee, as in the previous years, saw to it that this would be another successful party. Light entertainment was furnished by a barber shop quartet called the Four Shaving Mugs and dance music was supplied by a disc jockey.

Flowers were distributed to the women present and ample time was had for most people to become better acquainted with one another.

Stanley Platoz, *Secretary*

JACKSON-LANSING BRANCH

A regular monthly meeting was held November 9 in Jackson, Mich. R. W. Parker of the Michigan Water Resources Commission gave an excellent talk on plating pollution and waste disposal. George Snyder, Chief Engineer of the city of Jackson, and A. Green of the sewage disposal plant participated in the discussions that followed the talk.

An exceptionally large audience was present and all considered it an outstanding meeting of timely interest. The group all enjoyed a southern fried chicken dinner and the meeting ended with a showing of the General Electric movie, "Clean Waters."

R. W. Redmond, *Chairman*

LANCASTER BRANCH

A regular meeting was held November 13 at the Mt. Joy Legion.

Three new members were elected to membership and one application was presented.

Librarian George Wells then introduced the speaker, Edwin C. Rinker, technical director, Sel-Rex Precious Metals, Inc., who talked on "Bright Gold Plating." He stated the advantages of gold plating are the fact that the deposit is inert, has low electrical resistivity, and resists attack by most chemicals. His talk covered for the most part the material contained in his paper which he presented at the Philadelphia convention prior to its publication in the August issue of Plating.

At the present time the greatest use of this bright gold deposit is in the electronics field. It is also finding a lot of use in the decorative field. After Rinker finished his talk, he answered a number of questions.

H. A. Saylor, *Secretary-Treasurer*

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PC-11 requires only one primer coat and one finish coat for a tough, rugged, scuff-resistant, permanently flexible insulation.

Because it is 100% solids, PC-11 coats more surface per gallon thus reducing costs—and produces a coating from 1/16" to 1", as may be desired.

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LOS ANGELES BRANCH

A regular monthly meeting was held November 11 at the Rodger Young Auditorium, with dinner served at 7:00 P. M. PRESIDENT JOHN MILLHORN opened the business meeting at 8:00 P. M. with a record crowd of 114 members and guests present.

The branch librarian introduced the speaker of the evening, C. C. WEEKLY, Service Manager, Promat Division Poor and Company, Waukegan, Ill. His subject was "Past, Present, and Future of Zinc Plating and Conversion Coatings," which may be summarized as follows:

The speaker gave a brief history of plating in general, and then that of zinc plating. Weekly discussed standard alkaline zinc baths, and listed a few of the effects of bath variables: (1) increasing temperature increases cathode efficiencies, and increases throwing power; (2) increasing "M ratio" decreases cathode efficiencies, and increases throwing power; (3) increasing current densities lowers cathode efficiency and increases throwing power.

In closing it was stated that it was very important for the practical plater and the chemist to work closely together to produce a better and lasting finish.

A lively question and answer period followed and the meeting was adjourned at 10:15 P. M.

L. TRUMAN STONER, *Secretary*

NEWARK BRANCH

A regular meeting was held on November 20 at the Robert Treat Hotel.

Thirty-three members joined LIBRARIAN TOM AUSTIN to enjoy a dutch-treat dinner prior to the call to order by PRESIDENT ROBERT HORROCKS.

Applications for membership from HERMAN HACKENBURG, GEORGE RAK, RAY GRIFFIN, OSCAR K. IRGENS, and EDWARD L. GANN, JR., were ordered to take the regular course.

JOSEPH DI BERNARDO, WILLIAM WALLING, DEAN WARD, and THOMAS DOWNEY were elected to membership.

STANLEY GEFFON was transferred to the New York Branch.

The librarian next introduced the first speaker, MYRON DIGGIN, Hanson-Van Winkle-Munning Co. He gave a short but interesting talk on the nickel sulfamate solution.

ARTHUR KOHLER, technical director of Gumm Chemical Co., branch member, was the next speaker. His subject was "Background of Barrel Finishing."

Kohler gave a very interesting and informative talk on barrel finishing, ball burnishing, deburring, honing and also the use of zinc slugs to cut and burnish steel and brass parts.

At a special meeting on December 2, the following applications and elections were voted on:

Applications: EMIL P. MICHOTA, HAROLD J. O'BRIEN, STEVE SZABO, ERNEST A. LO PRESTI, WILLIAM E. MULLEN, ALFRED J. BABINSKI, and ZOLTAN PAROCZAY, JR.

Elections: GEORGE W. RAK, OSCAR K. IRGENS, EDWARD L. GANN, JR., and RAY N. GRIFFIN.

GEORGE REUTER, *Recording Secretary*

Some of the guests at the Newark Branch Christmas Party

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Address.....
City..... Zone..... State.....

NEW YORK BRANCH

The meeting, held November 13 at the Hotel Statler, was called to order by PRESIDENT A. AMATORE.

Amatore announced that a committee from the branch had visited MR. J. STERLING and found him in very poor condition.

The following men were elected to membership and duly installed: G. HERRING, A. EHRENSBERG, E. DELLA ROTTA, W. TILLES, A. JOHNSON, A. KAY, I. FELDMAN, F. GILL, P. PARMENTER, S. MISSEWOZ, V. COURT.

Then the meeting was turned over to D. HARTSHORN, acting librarian, who, in turn, presented JOHN F. O'BRIEN, of Joseph F. Kern, Jr., and Associates, Inc.

O'Brien's talk, which was most interesting, was on "Air Pollution and Dust Collectors."

LESTER LEVINSON,
Recording Secretary

PHILADELPHIA BRANCH

A meeting was held on December 11 at the Engineers' Club with about 40 attending. A dinner preceded the business meeting. The minutes of the October and November meetings were read and approved. One new active member was admitted.

The speaker of the evening was BRANCH PRESIDENT F. OTTENS who was introduced by A. M. POPE. His subject was "Phosphate Coatings of Metals." A brief history of the phosphate coating of metals was given. He explained how new fast-baking organic coatings, although superior in other properties, lacked adhesion, unless applied over a phosphatized metal. He described how the phosphate coating was only partly corrosion resistant due to voids in the coating and that this was overcome by a subsequent dip in very dilute chromic acid solution. The chemistry of the various types of coatings, the incorporation of detergent and wetting agents, the proper selection of primers to give maximum performance of subsequent finishing coats and other important features of phosphate coatings were well presented. Considerable discussion followed Ottens' extremely interesting talk.

I. WM. MARCOVITCH, *Secretary*

PROVIDENCE-ATTLEBORO BRANCH

The November meeting of the branch was held at the Providence Engineering Hall on November 16, at 8:15 P. M.

GEORGE BELCURE was chosen to head the exhibits committee, and a sincere effort will be made to have a large branch exhibit at the National Convention.

The feature of the evening was a movie, "Principles of Electricity," presented by the Narragansett Electric Light Co. The meeting adjourned at 10:30 P. M. with 25 members and guests present.

HENRY SHAVIER, *Secretary*

ROCHESTER BRANCH

A very interesting evening was enjoyed by the members of the branch on November 16 when EZRA BLOUNT, Editor of Product Finishing, was present to relate his experiences with the Japanese metal finishing industry during his recent tour of duty in Japan with the U. S. Air Force. Blount exhibited sample parts and photos collected in Japan and showed Kodachrome slides taken in Japanese plating shops and at meetings of the leaders of Japanese Electroplaters' Societies.

Also shown by Blount were reels of color movies showing scenic shots of famous landmarks, Japanese people and their countryside.

The discussion, questions and comments that followed were indicative of the interest of the group and would have continued longer had time permitted.

E. WALLIN, *Secretary*

ROCKFORD BRANCH

On November 9, Rockford held a meeting that many hope may be regarded as a turning point in the life of the branch. The evening was devoted to self-appraisal to determine what could be done to improve the branch.

WALKER EATON, the dean of the Rockford platers, started the ball rolling by telling of the beginnings of the branch. It certainly gave the background needed to continue the evening's discussion. The many points covered during the evening cannot be discussed here. It is sufficient to say that the branch members feel that the scope of the Society must be broadened; the interest in the branch must be broadened; and branch membership must be increased.

BRANCH PRESIDENT VERN WISSEN had everyone talking and the discussion continued until 10:45 P. M. at which time the group adjourned.

E. J. BUDDEN, *Secretary*

ST. JOSEPH VALLEY BRANCH

A regular monthly meeting of the branch was held at the Hotel Elkhart, Elkhart, Ind., on November 4. Twenty-three members and guests were present for the dinner and 26 attended the technical session.

ARTHUR G. WIEGAND, Manager of the Miracle Chemical Company of Ft. Wayne, was elected to active membership. Applications for membership were received from WILLIAM L. BOROUGH, Chemist, Bendix Aviation Corp., and JAMES H. ROWE, plater, South Side Plating Works.

DR. WIESNER advised the group of a special meeting to discuss the expansion of the AES to encompass more than just plating.

JOHN LOCKERBIE was endorsed to represent the Branch at the February 13 Interim Meeting at Toronto.

The Branch President opened the discussion period. CHET MCDOWELL asked about the stream pollution problem. Two plants in Goshen have made installations to prevent plating room waste stream pollution. R. WYSONG advised of steps taken by International Harvester plant at Fort Wayne to prevent leakage of tanks into open rivers. D. LEFEVRE had no further information from the Indiana Conservation Department.

RICHARD MCDOWELL asked for recommendations about chromium plating of a coffee pot made of stainless steel with silver solder patch-up at the seams. Dr. Wiesner advised use of auxiliary, separately connected, lead anodes to adjust current densities. W. LOCKWOOD suggested immersion in tank with current on and possibly reverse current precleaning. R. WYSONG suggested different composition of silver solder.

LIBRARIAN DUANE POUCHER then introduced the guest speaker, Dr. H. Wiesner, a member of the branch, who took over the speaking assignment due to the inability of the regularly scheduled speaker to be present. Dr. Wiesner's subject was "Rhodium Plating." He described two basic baths, the phosphoric and sulfate types and gave the main characteristics of each. He indicated that at 8 g/l concentration the efficiency of either bath is about equal, however current densities are lower for the phosphate bath. The acid content increases rapidly with usage of the bath and higher acid content decreases the efficiency of the bath. Operating temperatures are from 100 to 120° F with greater efficiency at higher temperatures.

Parts to be plated for jet engine use require an extremely thick rhodium coating, 0.0002 to 0.0004 inch thick. Usual decorative coating thicknesses range about 0.000002 to 0.000004 inch, similar to gold plating thickness.

Some of the difficult problems encountered with rhodium plating are that very minute amounts of organic impurities have extremely bad effects. Due to the cost of bath, approximately $60.00 per liter, it is extremely important to keep the baths absolutely clean. Lucite tanks have to be baked out since small amounts of Lucite cement may spoil a solution.

Rhodium is inert, therefore will not react with other chemicals, and no practical stripping method has been developed. If a piece shows defective plating it means a scrap part. On very thin coatings, stripping can be done by removing the nickel undercoat, thereby taking off the rhodium. Extremely bright deposits of rhodium are extremely brittle, full of internal stresses. Duller deposits are more ductile. The brightness of decorative parts is due to the finish of the undercoat.

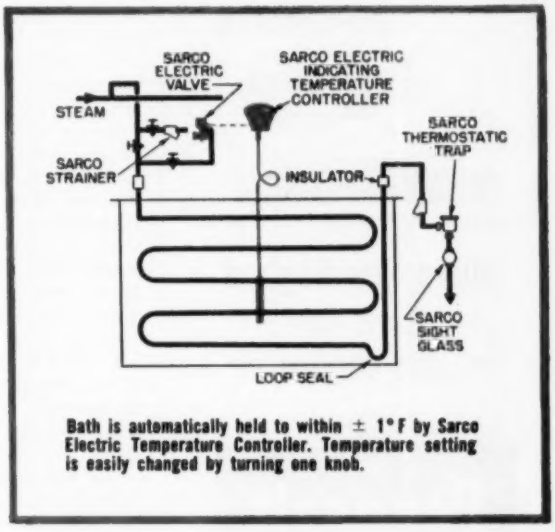
Dr. Wiesner's talk was illustrated with explanatory slides of bath efficiencies, hardness tests and plating variables of

How control of tank temperatures

improves product quality—

cuts operating costs

3 ways



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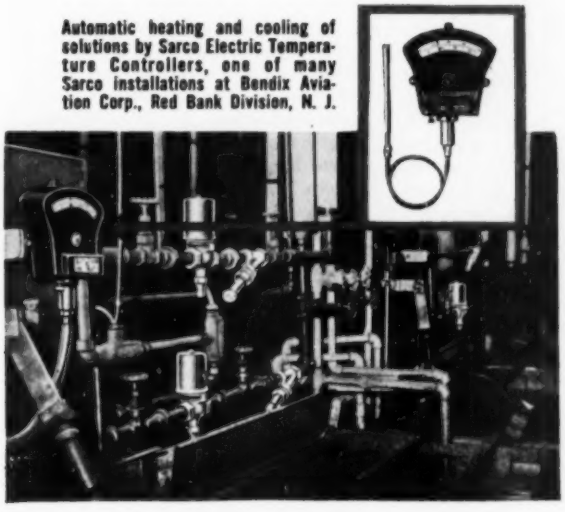

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- Daniels Plating Barrels
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- Stutz Plating Barrels
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EUGENE ROTH, *Secretary-Treasurer*

SAN FRANCISCO BRANCH

A meeting was held on November 12 at Gino's, Front and Clay Sts., San Francisco.

The business session was called to order about 8:30 P. M. by J. R. PATTENGER, who acted as both President and Secretary in the absence of the branch officers. The minutes of the October, 1953 meeting were read and approved. A letter of resignation, submitted by PRESIDENT STUART W. PANKEY, was read to the membership and accepted by the members present. Pankey has found it difficult to attend meetings of late and requested that he be allowed to resign as a branch officer.

A memo was read regarding a talk by MYRON DIGGIN of the Hanson-Van Winkle-Munning Company, and a choice of two dates were set for him—March 15, March 25.

The list of delinquent members and members "in transfer" were read and it was suggested that they be contacted again. The transfer of DAVID KILMURRAY of the A & A Plating Works, 1414 Stevenson St., San Francisco, transferred from the Buffalo branch, will be checked by SECRETARY SMITH.

The following applicants were approved for membership: HAROLD G. SPOTS, Diversey Corp.; ALAN H. NICHOLSON A. J. Lynch Co.; HOWARD J. LACKEY, JR., Industrial Materials Co.; and JOHN B. AGOSTINETTO, Western Gear Works.

HORACE J. SMITH, *Secretary*

TORONTO BRANCH

A regular meeting of the branch was held at the Royal York Hotel, Toronto, on November 13 with 40 members and guests present.

The meeting was called to order by PRESIDENT BEN CAMERON. Six new members were welcomed into the Society. Members were reminded of the annual dance to be held at the Kingsway Club.

The speaker, BERNIE COWAN of the Diversey Corporation, was introduced by CLARKE HODGINS. Bernie gave a very interesting talk on cleaners and cleaning problems. He covered the different agents that are put in cleaners to achieve certain results and produce a good cleaner; cleaning problems presented by zinc die castings and aluminum; supersonic cleaning and how cleaners are tested for efficiency.

On November 19, the annual dance of the branch was held at the Kingsway Club with 450 members and guests attending. Forty-five door prizes were given away. A floor show was the high light of the evening.

On November 6, the Toronto Branch visited the Buffalo Branch for one of their regular meetings. A very instructive and interesting time was had by all.

A regular monthly meeting was held at the Royal York Hotel on January 8, 1954.

Presentation of the Pot to Ellsworth P. Candee by Walter L. Pinner. This presentation took place at the annual Christmas banquet of the Waterbury Branch at Hotel Elton on December 10. The presentation was made after a talk by Walter on his trip to Mexico

PRESIDENT CAMERON announced that the February meeting will be held in Hall "C", which is a much larger room, to take care of the delegates to the Interim Meeting of the Supreme Society who have been invited to attend the regular dinner meeting. There will be special entertainment for the occasion.

ART SEVERS introduced the speaker, DON HUTCHISON of the Harshaw Chemical Company, who gave a very interesting talk on the history of nickel plating.

The discovery of nickel plating in 1842 was credited to a German scientist. The first commercial installation was started in Boston in 1865 by Isaac Adams, who used double nickel salts and soluble anodes in a 20 gallon solution to plate stove parts. The next commercial installation was 500 gallons, also in Boston. It was eventually taken over by Adams and is still operating as The Boston Nickel Plating Company.

The technical advances from this start were traced by the speaker. He elaborated on the work of O. P. Watts; the cobalt-nickel process; the publications of Blum and Hogaboom; the discovery of chromium plating; *p*H control and the advent of bright nickel.

During the question period, J. ACHESON, who has been connected with the plating industry for 60 years, pointed out that WALTER BARROWS, who was Toronto Branch President from 1912–1913, was responsible for the introduction of the cobalt-nickel bath.

On May 1, 1954 the branch will participate in an annual Regional Convention at the General Brock Hotel in Niagara Falls. Registration starts at 12:00 noon. There will be speakers in the afternoon and a dinner followed by a dance at night. Members from all branches of the Society are cordially invited to attend.

J. G. SMITH,
Branch Correspondent

Membership Report of the A. E. S.

Elections

BOSTON: Robert C. Matthews

CHICAGO: Albert Benjamin, E. D. Fontaine, James J. Perry, Joseph J. Schaefer

CLEVELAND: Louis Akos, Robert E. Scheel

DALLAS-FORT WORTH: Earl J. Brown, Armond G. Charron, James H. Filkins, Paul A. Finn, James L. Lewis, Glendel E. Monroe

HAMILTON: David J. Collver, Harold Revill, Charles K. Zenwirt

HARTFORD: Myron M. Zervas

INDIANAPOLIS: Kenneth H. Bennett, John Eltzroth, James W. Goas, Charles E. Kelley, Ben F. Leckron, Guy M. Marquis, Earl H. Messmore, Mitchell G. Osman

JACKSON-LANSING: Gerald E. Calhoun, Robert H. Hoff, Robert E. Tobin

LANCASTER: Luis Huber, William D. Murray, Lawrence H. Wasser

LOS ANGELES: Glenn A. Fitzgerald, John S. Hunter, Jr., Henry H. Kondo, Bernard Lupescu, Ken M. Lupescu, M. J. Mazzarese, Frank Serot, Benjamin Singer, Filmore S. Witte

LOUISVILLE: Robert D. Jackson, Lewis H. Willoughby, E. E. Willweit

MILWAUKEE: Adrian P. Brietzke, Thomas Coyle, Richard Coyle, Joseph V. Drzewiecki, Robert A. Heron, Theodore Klinker, Carl Sundquist, Howard B. Williams

NEWARK: Alfred J. Babinski, Edward L. Gann, Jr., Ray N. Griffin, Herman J. Hackenburg, Oscar K. Irgens, Ernest A. LoPresti, Emil P. Michota, William E. Mullen, Harold J. O'Brien, Zoltan Paroczay, Jr., George W. Rak, Steve Szabo

PHILADELPHIA: Harry S. Isett

ROCKFORD: Francis B. Bryant

SAGINAW VALLEY: Dennis J. Goddeyne, George G. Germaine, Grayland T. Larsen, Donald R. Malthaner, Frank A. Powada, J. M. Small, A. W. Sundwick

ST. JOSEPH VALLEY: William L. Borough, James H. Rowe

SAN FRANCISCO: John B. Agostinetto, Howard J. Lackey, Jr., William T. McFarland, Alan H. Nicholson, Harold G. Spotts

SYRACUSE: Donald R. Dashnaw, John H. Johnson, Frederick McNish, John J. Otis, Lawrence A. Phillips, Michael Rubycz, Harold I. Spencer

TOLEDO: William A. Cottingham, William Ehman, Ray C. Hooker

TORONTO: Earl A. Armitage, John D. Buchan, Anthony V. Goberis

MEMBER-AT-LARGE: F. Lenk, Cardiff, Wales, Gr. Britain

Reinstatements

BOSTON: J. W. Coulouris, Maurice Kraff

Membership Competition

BRANCH	Membership April 1, 1953*	New Members	Net Change in Membership	Per Cent Net Change	Sustaining Membership Credits*
First Group					
Los Angeles	236	46	+38	+16.1	14
Newark	251	27	+22½	+ 9.0	11
Hartford	151	19	+12	+ 7.9	5
New York†	352	34	+21	+ 6.0	18
Detroit	504	47	+28	+ 5.6	52
Grand Rapids	173	12	+ 9½	+ 5.5	13
Philadelphia	198	19	+ 5½	+ 2.8	11
Pittsburgh	142	6	+ 2	+ 1.4	6
Melbourne	169	19	+ 1	+ 0.6	..
Waterbury	130	6	+ ½	+ 0.4	13
Chicago	477	21	0	0	83
Milwaukee	164	36	0	0	8
Boston	155	3	− ½	− 0.3	6
Cleveland	236	17	− 1	− 0.4	20
Bridgeport	158	9	− 3½	− 2.2	4
Toronto	146	14	−10	− 6.8	8
Second Group					
Dayton	76	11	+ 8½	+11.2	3
Montreal	80	8	+ 8	+10.0	1
Syracuse	128	25	+12½	+ 9.8	4
Saginaw Valley‡	103	12	+ 9	+ 8.7	..
Indianapolis	105	15	+ 6	+ 5.7	1
San Francisco	74	15	+ 3½	+ 4.7	..
Twin City	71	4	+ 2½	+ 3.5	1
St. Joseph Valley	78	10	+ 1½	+ 1.9	4
Sydney	82	8	− 2	− 2.4	..
Baltimore-Washington	93	7	− 3	− 3.2	4
Cincinnati	92	4	− 3½	− 3.8	2
New Haven	100	..	− 5½	− 5.5	7
Providence-Attleboro	95	3	− 5½	− 5.8	2
Rochester	107	8	−11½	−10.7	− 3
Buffalo	106	1	−12	−11.3	2
St. Louis	109	8	−18	−16.5	10
Third Group					
Springfield	57	10	+ 9	+15.8	2
Hamilton	25	3	+ 3	+12.0	4
Rockford	63	6	+ 6½	+10.3	3
Western Ontario	22	2	+ 2	+ 9.1	▲
Lancaster	69	3	+ 3	+ 4.3	2
Adelaide	52	6	+ 1	+ 1.9	..
Dallas-Fort Worth	53	6	+ 1	+ 1.9	2
Houston	42	1	+ ½	+ 1.2	1
Columbus	52	1	+ ½	+ 1.0	1
Jackson-Lansing	61	3	+ ½	+ 0.8	..
Kansas City	46	6	0	0	..
Southeastern	50	2	0	0	1
Louisville§	44	3	− 2½	− 5.7	2
Toledo	56	6	− 4	− 7.1	3
Allentown-Reading	53	..	− 4	− 7.5	5
Wichita	41	5	− 7	−17.1	2
Canadian Branches, unallocated					9
Other credits to be allocated					5
Outside Competition					
Portland	...	18	.....	.....	..
At Large	138	21	+18½	.....	..
Total AES	6,065	578	+161½	+ 2.7	356

Active Membership, November 30, 1953 6,227

*Subject to correction. †, ‡, §Winners in first, second and third groups, respectively of 1952–1953 membership competition. ▲Proper credit to individual Canadian Branches not available.

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PHILADELPHIA: John J. Gumpper

ST. JOSEPH VALLEY: Edwin Krook

SYRACUSE: Robert W. Hergonson

Transfers

Paul D. Harper from Detroit to Boston; N. E. Searles to Syracuse from Boston; Earl D. Creese to Dayton from Cincinnati; Lorin E. Correll to Rochester from Cleveland; Jack Kershaw from Grand Rapids to Cleveland; Don D. Johnson from Grand Rapids to Detroit; Francis J. Reha to Saginaw Valley from Detroit; Emmett H. Babcock from Chicago to Indianapolis; Frank Hartwig from Chicago to Indianapolis; James Whyte, Jr., from Bridgeport to Los Angeles; Stanley Geffon to New York from Newark; Wilmar W. Kaufman to Detroit from Saginaw Valley; Edwin Krook to Grand Rapids from St. Joseph Valley; Richard E. Loupee to Kansas City from St. Louis; Richard L. Nyquist to St. Louis from Waterbury

Resignations

JACKSON-LANSING: John W. Richardson

SAN FRANCISCO: John T. Hatcher

Suspensions

BOSTON: John E. Curtis, Philip H. Eisenberg

CHICAGO: W. L. Berberick, J. J. Cooper, Louis P. Duncan, Wm. C. Hammill, R. R. Jenness, S. M. Linick, Edwin Royek, H. C. Warren, J. N. Williams

CLEVELAND: E. W. Hauck, George J. Hoover, Erich X. Kreuzer, Paul G. Lackney, Gene LaSarge, A. P. Puro, Maurice B. Schramm, D. Dale Stiteler, Steven Tachovaka, Thomas R. Thomas, William Tutle

JACKSON-LANSING: Robert V. Le Fere

ROCHESTER: Frank M. Brock, Henry Burns, Frank Cornwall, Joseph Diesinger, Joseph Dutton, Judson Elster, Ernest Fasano, Michael Fasano, William J. Kushner, Milton G. McCormick, Gale L. Pollow, Emil Pottridge, Robert C. Steveling, Leonard Treman, Pacquale Trimaldi

ST. LOUIS: Ed Mroz

SAN FRANCISCO: E. B. Leland, J. H. Theriault

Deaths

BOSTON: Francis Mackie

CHICAGO: E. L. Ingram, J. J. Witte

LOS ANGELES: Allen F. Savage

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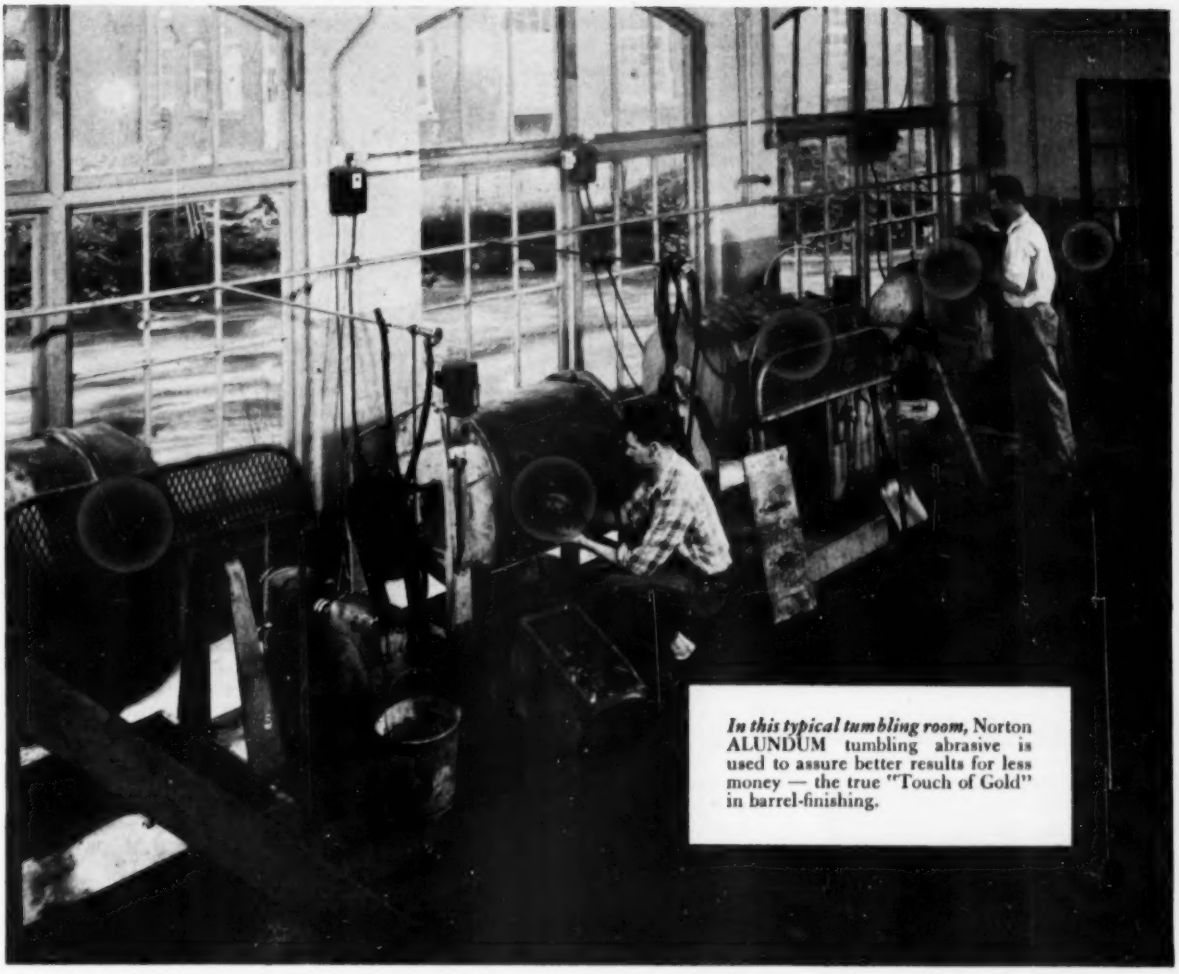

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Start with ALUNDUM* tumbling abrasive . . . and you'll finish with the

"TOUCH OF GOLD"

Especially developed to eliminate hand finishing of stampings, forgings and castings, Norton ALUNDUM tumbling abrasive is processed to impart a strong, blocky shape to the individual grains, with no sharp projections to mar the work. Here are some of the reasons why barrel-finishing with this tough, hard abrasive is standard in leading plants:

- It provides the fastest, most economical method of finishing metal parts to exact dimensions and surface finishes.
- It removes burrs, flash, tool marks and heat scale from large quantities of parts, saving endless man-hours.
- It eliminates many slow hand-finishing operations, increases production rate of parts ranging in size from tiny needles to hefty castings.

Learn how ALUNDUM tumbling abrasive can bring *you* the value-adding, cost-cutting "Touch of Gold" — by giving you constantly better finishing results while helping you shorten tumbling cycles, reduce scrap and reworking. Whether or not you have barrel-finishing, Norton will gladly make test runs for you, to show you what this process with ALUNDUM tumbling abrasive will do for you.

See your Norton Distributor, and ask him for the new edition of the 55-page booklet on barrel-finishing. Or write to NORTON COMPANY, Worcester 6, Mass.

Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

G-265

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ABRASIVES

Making better products . . . to make other products better

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CLARIFICATION of

PLATING SOLUTIONS | NICKEL DIP SOLUTIONS | NEUTRALIZER SOLUTIONS

ANY QUANTITY

BONUS PERFORMAN
with lasting reliability

The engineering and construction featu
filters add up to maximum clear filtrate w
greater operating conveniences, and less
and expense. The general design permi
materials best suited to the solution req
filter leaves with ample flow space on bot
mum filtration area. Outside lockup sim
tion of filter leaf and bag assemblies. An
cleaning method practically eliminates th
inconvenience of dismantling the filter after every cycle. INDUSTRIAL filters are often in operation for months without removing the cover — cutting downtime to a minimum. All these features have been proved in long-life service — your assurance of dependable bonus performance.

Full particulars and recommendations on any filtration job will be given upon request.

4563

INDUSTRIAL
FILTER & PUMP MFG. CO.
5914 Ogden Avenue, Chicago 50, Illinois

PRESSURE FILTERS
DEMINERALIZERS
RUBBER LININGS
CORROSION TEST CABINETS
HEAT EXCHANGERS

CHICAGO: Henry Deyne
INDIANAPOLIS: William N. Cunnington
MILWAUKEE: Bert G. Allen, Robert J. Baltzell, Joseph Birbaum, Frank Buschner, Nikolas DiCesare, Stanley Mey, L. J. Moyes, Eugene F. Rinehart, Robert R. Seeber, Jerome Stowasser, George P. Varnish, James F. Wright
PHILADELPHIA: John J. Gumpper
ST. JOSEPH VALLEY: Edwin Krook
SYRACUSE: Robert W. Hergonson

Transfers

Paul D. Harper from Detroit to Boston; N. E. Searles to Syracuse from Boston; Earl D. Creese to Dayton from Cincinnati; Lorin E. Correll to Rochester

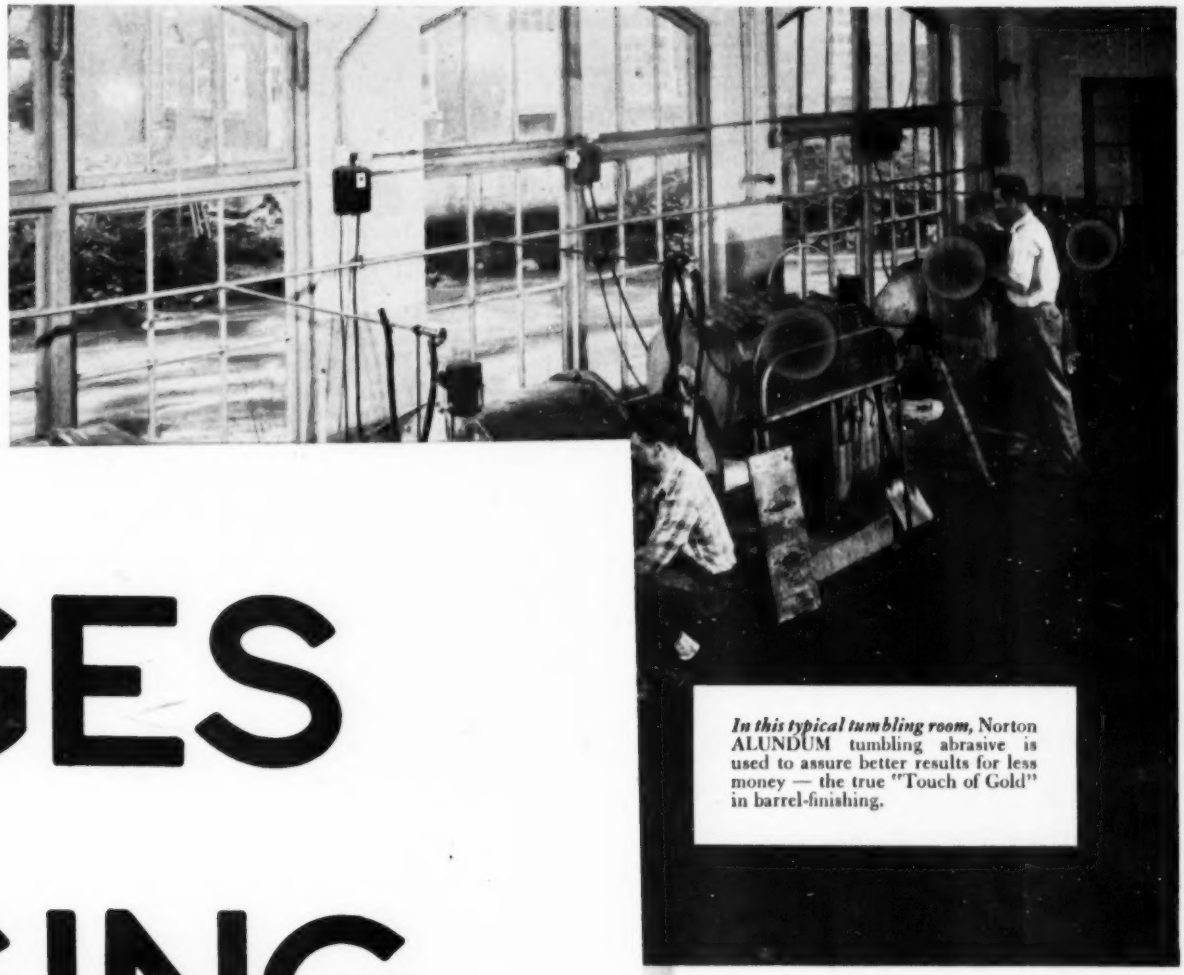
PAC

MISS

Steven Tachovaka, Thomas R. Thomas, William Tutle
JACKSON-LANSING: Robert V. Le Fere
ROCHESTER: Frank M. Brock, Henry Burns, Frank Cornwall, Joseph Diesinger, Joseph Dutton, Judson Elster, Ernest Fasano, Michael Fasano, William J. Kushner, Milton G. McCormick, Gale L. Pollow, Emil Pottridge, Robert C. Steveling, Leonard Treman, Pacquale Trimaldi
ST. LOUIS: Ed Mroz
SAN FRANCISCO: E. B. Leland, J. H. Theriault

Deaths

BOSTON: Francis Mackie
CHICAGO: E. L. Ingram, J. J. Witte
LOS ANGELES: Allen F. Savage



In this typical tumbling room, Norton ALUNDUM tumbling abrasive is used to assure better results for less money — the true "Touch of Gold" in barrel-finishing.

GES

SING

* tumbling abrasive . . .
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NORTON
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CLARIFICATION of

PLATING SOLUTIONS | NICKEL DIP SOLUTIONS | NEUTRALIZER SOLUTIONS

ANY QUANTITY

BONUS PERFORMANCE
with lasting reliability

The engineering and construction features of INDUSTRIAL filters add up to maximum clear filtrate with less floor space, greater operating conveniences, and less maintenance delays and expense. The general design permits the use of the materials best suited to the solution requirements. Vertical filter leaves with ample flow space on both sides offer maximum filtration area. Outside lockup simplifies the installation of filter leaf and bag assemblies. An exclusive air-wash cleaning method practically eliminates the usual labor and inconvenience of dismantling the filter after every cycle. INDUSTRIAL filters are often in operation for months without removing the cover — cutting downtime to a minimum. All these features have been proved in long-life service — your assurance of dependable bonus performance.

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4583

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RUBBER LININGS
CORROSION TEST CABINETS
HEAT EXCHANGERS

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PHILADELPHIA: John J. Gumpper

ST. JOSEPH VALLEY: Edwin Krook

SYRACUSE: Robert W. Hergonson

Transfers

Paul D. Harper from Detroit to Boston; N. E. Searles to Syracuse from Boston; Earl D. Creese to Dayton from Cincinnati; Lorin E. Correll to Rochester from Cleveland; Jack Kershaw from Grand Rapids to Cleveland; Don D. Johnson from Grand Rapids to Detroit; Francis J. Reha to Saginaw Valley from Detroit; Emmett H. Babcock from Chicago to Indianapolis; Frank Hartwig from Chicago to Indianapolis; James Whyte, Jr., from Bridgeport to Los Angeles; Stanley Geffon to New York from Newark; Wilmar W. Kaufman to Detroit from Saginaw Valley; Edwin Krook to Grand Rapids from St. Joseph Valley; Richard E. Loupee to Kansas City from St. Louis; Richard L. Nyquist to St. Louis from Waterbury

Resignations

JACKSON-LANSING: John W. Richardson

SAN FRANCISCO: John T. Hatcher

Suspensions

BOSTON: John E. Curtis, Philip H. Eisenberg

CHICAGO: W. L. Berberick, J. J. Cooper, Louis P. Duncan, Wm. C. Hammill, R. R. Jenness, S. M. Linick, Edwin Royek, H. C. Warren, J. N. Williams

CLEVELAND: E. W. Hauck, George J. Hoover, Erich X. Kreuzer, Paul G. Lackney, Gene LaSarge, A. P. Puro, Maurice B. Schramm, D. Dale Stiteler, Steven Tachovaka, Thomas R. Thomas, William Tutle

JACKSON-LANSING: Robert V. Le Fere

ROCHESTER: Frank M. Brock, Henry Burns, Frank Cornwall, Joseph Diesinger, Joseph Dutton, Judson Elster, Ernest Fasano, Michael Fasano, William J. Kushner, Milton G. McCormick, Gale L. Pollow, Emil Pottridge, Robert C. Steveling, Leonard Treman, Pacquale Trimaldi

ST. LOUIS: Ed Mroz

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Deaths

BOSTON: Francis Mackie

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LOS ANGELES: Allen F. Savage

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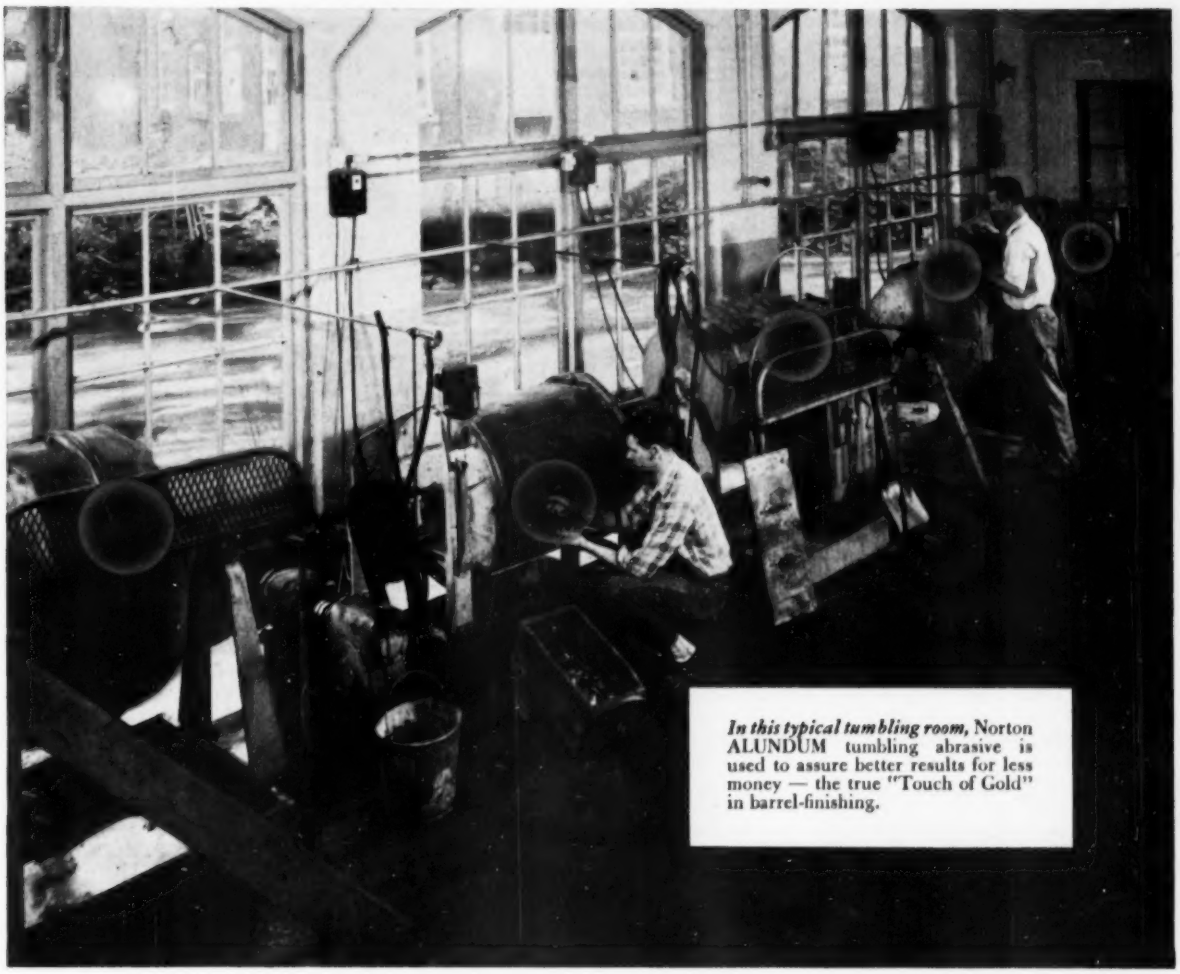

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SUSTAINING MEMBERSHIP LIST*

As of February 1954

(Figures in parenthesis indicate number of memberships held)

Accurate Electro-Plating, Inc.
Philadelphia, Pa. (Phil)
Acme Galvanizing, Inc.
Milwaukee, Wis. (Milw)
Acme Plating Company, The
Cleveland, Ohio (Clev)
Acme Steel Company
Chicago, Ill. (Chic)
Adolph Plating, Inc.
Chicago, Ill. (Chic)
Advance Plating Company, The
Cleveland, Ohio (Clev)
Aetna Electroplating Company
Philadelphia, Pa. (Phil)
Alert Supply Company
Los Angeles, Calif. (L. A.)
Allen-Bradley Company
Milwaukee, Wis. (Milw)
Allied Industrial Products, Inc.
Chicago, Ill. (Chic)
Allied Research Products, Inc.
Baltimore, Md. (Bal-W)
Alsop Engineering Corporation
Milldale, Conn. (Hart)
Aluminum Company of America
New Kensington, Pa. (Pitt)
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Chicago, Ill. (Chic)
American Cabinet Hardware Corporation
Rockford, Ill. (Rock)
American Can Company
Maywood, Ill. (Chic)
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American Fixture & Manufacturing Co.
St. Louis, Mo. (St. L.)
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American Radiator & Standard Sanitary Corporation
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Cambridge, Mass. (Bost)
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Bart-Messing Corporation
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Beacon Supply Company
Chelsea, Mass. (Bost)
Beech Aircraft Corporation
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Belke Manufacturing Company
Chicago, Ill. (Chic)
Bell & Howell Company
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Bell Telephone Laboratories, Inc.
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Bendix Prods. Div., Bendix Aviation Corp.
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Buckingham Products Company
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Chase Brass & Copper Company
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Springfield, Mass. (Spfd)
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Derby, Conn. (N. H.)
Chrysler Corporation (2)
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Clayton Mark & Company
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Clevite-Brush Development Company, Division of Clevite Corporation
Cleveland, Ohio (Clev)
Clinton Company, The
Chicago, Ill. (Chic)
Clinton Supply Company, Inc.
Chicago, Ill. (Chic)
Codman, F. L. & J. C. Company
Rockland, Mass. (Bost)
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Coffeyville, Kansas (Wich)
Corona Corporation
Syracuse, N. Y. (Syr)
Cowles Chemical Company
Cleveland, Ohio (Clev)
Crane Company
Chicago, Ill. (Chic)
Croname, Incorporated
Chicago, Ill. (Chic)
Crown City Plating Company
Pasadena, Calif. (L. A.)
Crown Cork & Seal Company
Baltimore, Md. (Bal-W)
Crown Rheostat & Supply Company
Chicago, Ill. (Chic)
Cutler-Hammer Company
Milwaukee, Wis. (Milw)

Darco Dept., Atlas Powder Company
New York, N. Y. (N. Y.)
Davies Supply & Manufacturing Company
St. Louis, Mo. (St. L.)
Daystrom Furniture Div., Daystrom, Inc.
Olean, N. Y.
Detroit Plating Industries
Detroit, Mich. (Detr)
Diamond Alkali Company
Painesville, Ohio (Clev)
Diamond Plating Company
Memphis, Tenn. (S'east)
Diversey Corporation, The
Chicago, Ill. (Chic)
Dixie Electro Plating Company
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Dura Div., Detroit Harvester Company
Toledo, Ohio (Tldo)
Dura-Chrome of Chicago, Inc.
Chicago, Ill. (Chic)

Eastman Kodak Company (2)
Rochester, N. Y. (Roch)
Eaton Manufacturing Company
Cleveland, Ohio (Clev)
Ekco Products Company
Chicago, Ill. (Chic)
Electric Auto-Lite Company, The (2)
Toledo, Ohio (Tldo)

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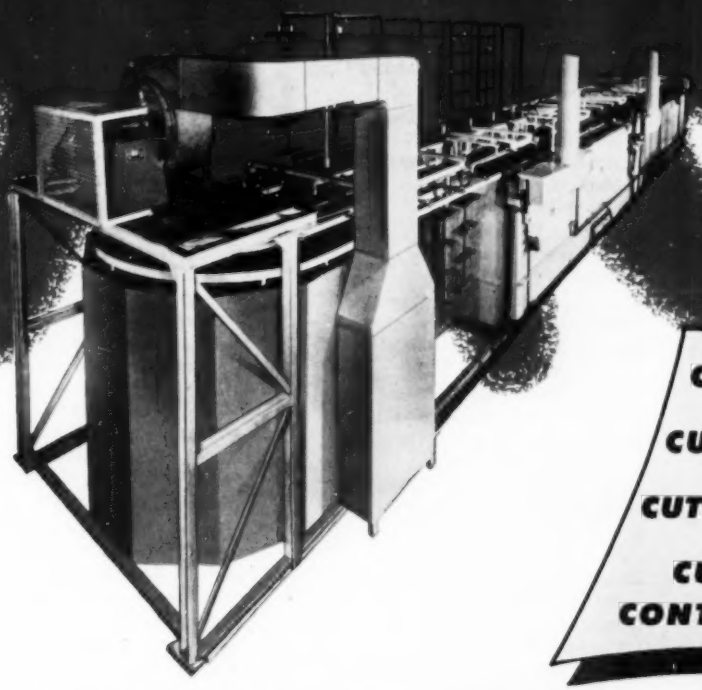
NEW WAGNER *PRODUCTION-PROVEN* AUTOMATIC



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This brand new, fully automatic electroplating machine, under engineering study for years, its details in the testing laboratory for months, is now thoroughly proven in continuous production operation.

Powered by one electric motor, it uses less than half the power required for any comparative automatic plater. Fully hydraulic in control and operation, it has achieved new goals in versatile, smooth, trouble free, easily maintained, quiet, efficient operation.

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And, dozens of other outstanding features.

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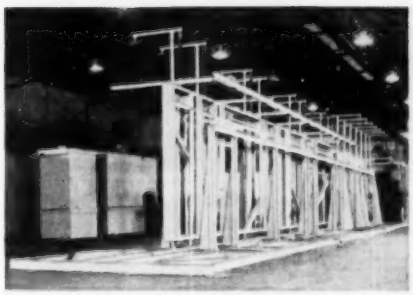
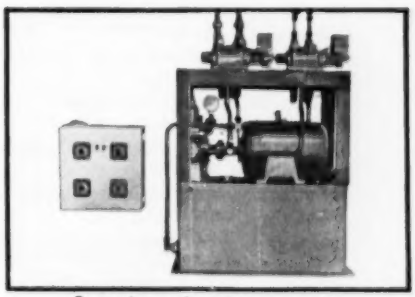


Moving parts in central unit



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Electrolux Corporation
Greenwich, Conn.
Electro-Platers Company
Milwaukee, Wis. (Milw)
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New Haven, Conn. (N. H.)
Erie Plating Company
Erie, Pa. (Clev)
Felt & Tarrant Manufacturing Company
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Finishing Publications, Inc.
Westwood, N. J. (Nwk)
Ford Motor Company (5)
Detroit, Mich. (Detr)
Formax Manufacturing Company
Detroit, Mich. (Detr)
Frigidaire Div., General Motors Corp.
Dayton, Ohio (Dayt)

General Electric Company
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Research Laboratories Division,
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Gerity-Michigan Corporation
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Chicago, Ill. (Chic)
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International Nickel Co., Inc., The (5)
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Pittsburgh, Pa. (Pitt)
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Keeler Brass Company
Grand Rapids, Mich. (Gr R)
Kelly Plating Company, The
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Knape & Vogt Manufacturing Company
Grand Rapids, Mich. (Gr R)
Knapp-Monarch Company
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Knight Plating Company
Detroit, Mich. (Detr)
Kocour Company
Chicago, Ill. (Chic)
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Matoon, Ill. (Chic)
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Indianapolis, Ind. (Idpls)
Manderscheid Company, The
Chicago, Ill. (Chic)
Matchless Metal Polish Company, The
Chicago, Ill. (Chic)
Mattatuck Manufacturing Company
Waterbury, Conn. (Wtby)
Maurer Supply Company
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McGean Chemical Company, The
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Milwaukee Plating Company
Milwaukee, Wis. (Milw)
Minneapolis-Honeywell Regulator Co.
Minneapolis, Minn. (Tw Cty)
Mitchell-Bradford Chemical Co., The
Bridgeport, Conn. (Bdpt)
Modern Plating Company
Los Angeles, Calif. (L. A.)
Modern Plating Company, The
Chicago, Ill. (Chic)
Modern Plating Corporation
Freeport, Ill. (Chic)
Moore Drop Forging Company
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Motor Products Corporation
Detroit, Mich. (Detr)
Mutual Chemical Company of America
Baltimore, Md. (Bal-W)

George L. Nankervis Company
Detroit, Mich. (Detr)
National Aniline Div., Allied Chemical &
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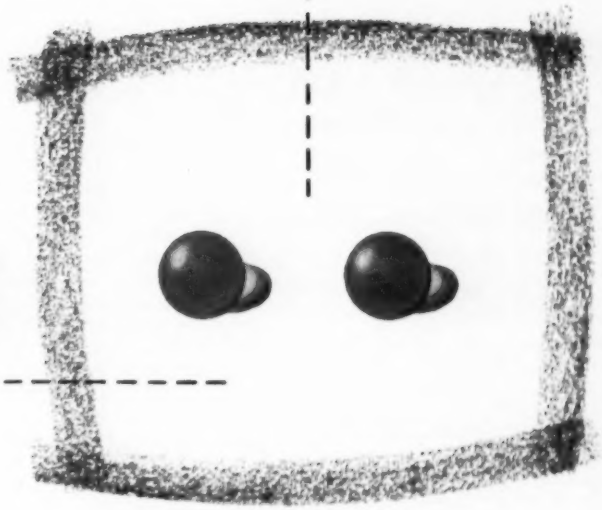

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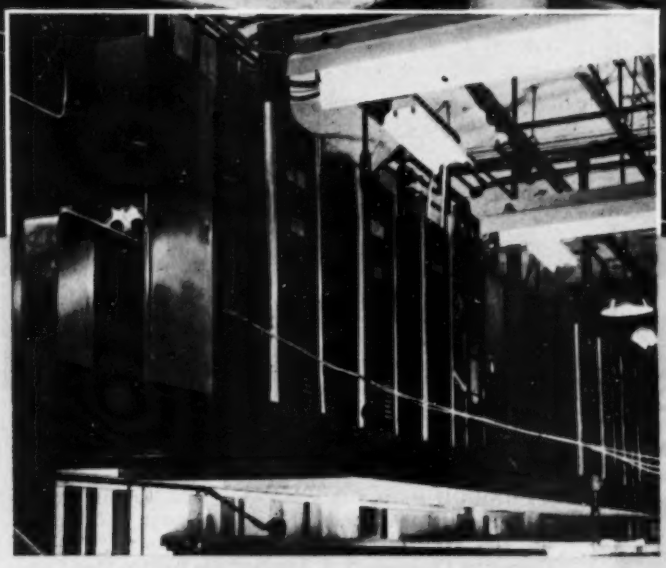

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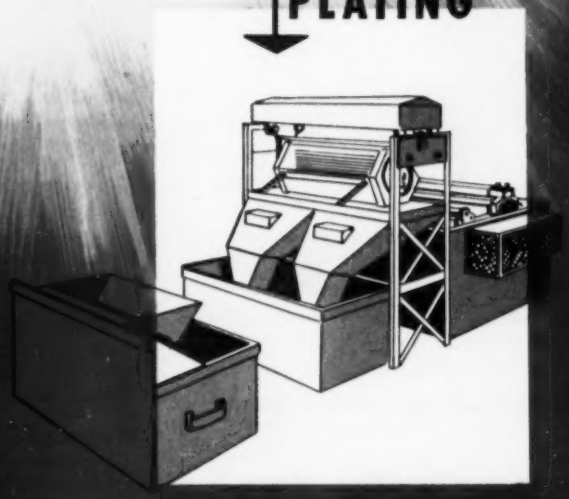

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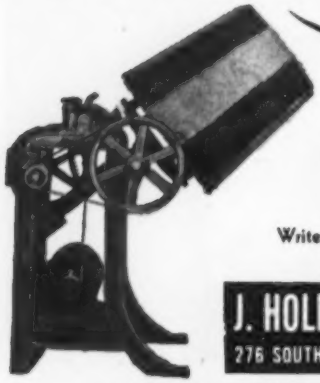

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ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P. M. in Elkhart Hotel, Elkhart, Ind. Secretary-Treasurer, Eugene Roth, 739 N. College Street, South Bend 28, Ind. Research Finance Committee Chairman, Ralph Brouwer, 361 Maple Avenue, Holland, Mich.

ST. LOUIS meets second Wednesday of each month at the York Hotel, 6th and Market, St. Louis, Mo. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo. Research Finance Committee Chairman, to be appointed.

SAN FRANCISCO meets second Thursday of each month, alternating between St. Julien Restaurant, 140 Battery Street, San Francisco, and El Curtola Restaurant, 510 17th Street, Oakland. Secretary-Treasurer, Horace J. Smith, 319 Alta Loma Drive, South, San Francisco, Calif. Research Finance Committee Chairman, to be appointed.

SOUTHEASTERN meets second Friday of each month at the Belmont Steak House, Atlanta, Ga. Secretary-Treasurer, Charles A. Collings, P. O. Box 1088, Atlanta, Ga.

SPRINGFIELD meets fourth Monday of each month in the Ivy House, Route 5, West Springfield, Mass. Secretary, Roger R. Heroux, 1497 Longmeadow Street, Longmeadow, Mass. Research Finance Committee Chairman, Arthur Pearson, 102 Ely Avenue, West Springfield, Mass.

SYDNEY, AUSTRALIA meets second Thursday of each month at 7:30 P. M. in the Trust Building, King and Castlereagh Streets. Secretary-Treasurer, B. Bridgement, 19 Adelaide Street, Belmore, Sydney, N. S. W., Australia.

SYRACUSE meets third Monday of each month in Richard's Restaurant. Secretary, Lindley Wood, 1329 Bellevue Avenue, Syracuse 4, N. Y. Research Finance Committee Chairman, George W. Cavanaugh, 129 Kenwood Avenue, Syracuse 8, N. Y.

TOLEDO meets first Thursday of each month at Park Lane Hotel. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, Robert L. Edwards, 1106 Dovercourt Road. Toronto, Ont., Canada. Research Finance Committee Chairman, K. Wells, 370 Victoria Avenue, Toronto, Ont., Canada.

TWIN CITY meets first Monday of each month, October through June, in the Covered Wagon (Lodge Room), 114 S. 4th Street, Minneapolis, Minn., with dinner at 6:30 P. M. and business and technical session at 8:00 P. M. Secretary-Treasurer, Robert L. Buckley, c/o Industrial Chemical & Equipment Company, 205 11th Avenue So., Minneapolis 15, Minn. Research Finance Committee Chairman, to be appointed.

WATERBURY meets second Thursday of each month in Elton Hotel. Dinner, 6:30 P. M.; meeting, 8 P. M. Secretary-Treasurer, Spencer L. Henn, P. O. Box, Drawer B, Chesbire, Conn.

WESTERN ONTARIO meets third Friday of each month in William Pitt Hotel, Chatham, Ontario. Secretary-Treasurer, K. W. Farquhar, 54 Napier Street, Ltd., Wallaceburg, Ontario, Canada.

WICHITA meets fourth Wednesday of each month at 6:30 P. M. at Lydroy's Eighty-one Grill. Secretary-Treasurer, Harry D. Burgess, 249 North Mosley, Wichita, Kans.

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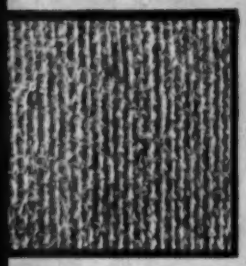

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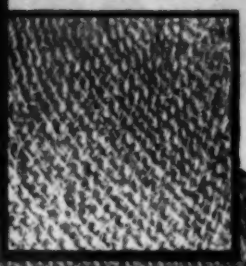

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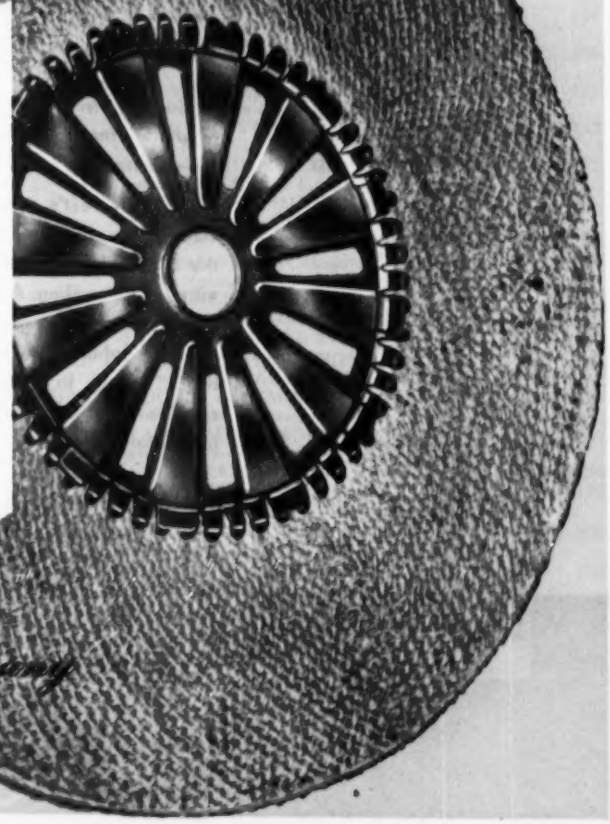

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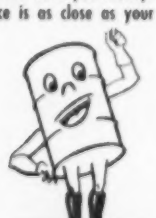

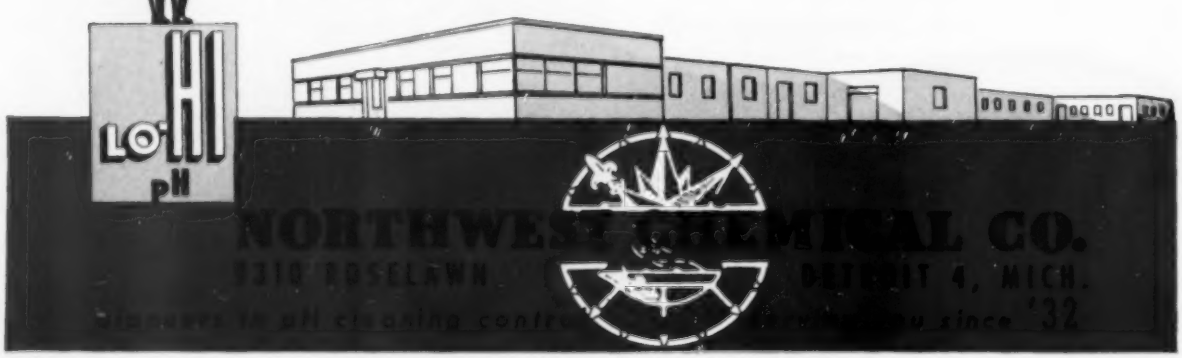

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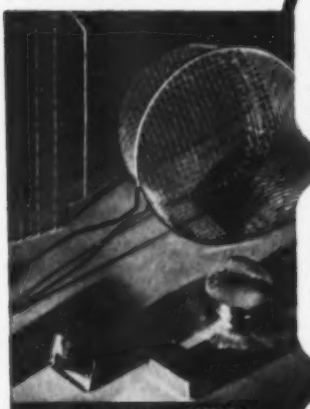
VIA HIGH SPEED Electrotinning



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Future Meetings

ST. JOSEPH VALLEY BRANCH, AES. Annual Inspection Trip, February 3, 1954.

SAGINAW VALLEY BRANCH, AES. Annual Dinner-Dance at Zehnder's Hotel, February 6, 1954.

INTERIM MEETING, AES., at the Royal York Hotel, Toronto, Ontario, Canada, on February 13, 1954 at 10:00 A. M.

DAYTON BRANCH, AES. 9th Annual Educational Session and Dinner-Dance at the Biltmore Hotel on February 27, 1954.

BALTIMORE WASHINGTON BRANCH, AES. Annual Educational Session and Banquet on March 13, 1954 at the Lord Baltimore Hotel, Baltimore, Md.

ROCKFORD BRANCH, AES. Annual Educational Session and Dinner-Dance at the Faust Hotel, April 3, 1954.

LOS ANGELES BRANCH, AES. Annual Educational Session and Dinner-Dance at the Ambassador Hotel, April 24, 1954.

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LEA newsreel

FEBRUARY 1954

THE LEA METHOD OF FINISHING

The Lea Manufacturing Company pioneered and continues to specialize in the development of CLEAN-WORKING polishing and buffing compositions. These special methods minimize cleaning by employing selected grades of LEA COMPOUND, LEAROK, or other special compositions which virtually eliminate excessive cleaning or hand-scrubbing common with regular heavy grease compounds.

Here are some typical case studies of Lea Methods.

CASE STUDY #1

Material: Sterling silver.

Article: Table flatware.

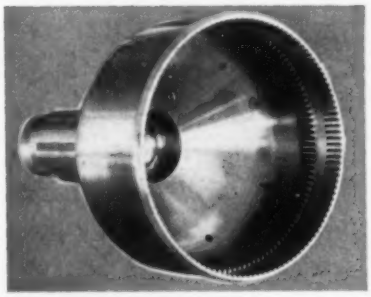
Method of Forming: Customary for this type of work.

Final Finish: Bright Butler.

Lea Method:

1. Cut-down buffing with Tripoli.
2. Cleaning.
3. Lea Compound Grade A-1 or 5023 on a 6" diameter loose muslin buff at 4400 r.p.m.

Remarks: The Lea Method produces a more pleasing finish in about half the time than that produced by any wet method. When a more pronounced Butler finish is desired, a packed buff with Grade A-63 Lea Compound is used.



CASE STUDY #2

Material: Steel.

Article: Bearings, motor parts and other aircraft engine parts, some with counter-sunk holes.

Method of Forming: Forging.

Final Finish: Smooth with burrs removed and slight radius provided.

Lea Method:

Lea Compound Grades "L," "B" or "C" at 5500 surface feet per minute on various types of buffs, string brushes, leather bobs, etc., depending upon the shape of the piece and the accessibility of the surface to be abraded.

Remarks: Work of this type had previously been done by hand with files, emery cloth or burring tools. Lea Compound removes all metal marks and burrs much faster and more economically than hand work. Tolerances are protected by the flexibility of the Lea Compound wheel.

CASE STUDY #3

Material: Brass and bronze.

Article: Bookends and novelties.

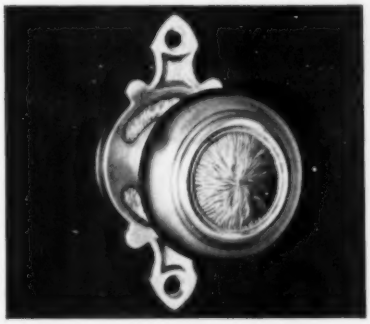
Method of Forming: Casting.

Final Finish: Brushed effect.

Lea Method:

1. Lea Compound Grade "C" on 8" loose wheel at 1500 to 2000 r.p.m.
2. Lacquering.

Remarks: Lea Compound is especially applicable to this type of work as there are numerous recesses in which buffing dirt would lodge with the older method using Tripoli buffing and wet scratch brushing. Accordingly, costly hand cleaning is thereby eliminated.



CASE STUDY #4

Material: Brass.

Article: Door knobs and escutcheon plates.

Method of Forming: Stamping.

Final Finish: Oxidized and relieved.

Lea Method:

1. Cut-down buffing with Tripoli of surface previously polished.
2. Clean.
3. Oxidized in liquid sulphur.
4. Lea Compound Grade "FG" on a 12" diameter loose muslin buff at 1200 r.p.m.
5. Lacquering.

Remarks: Grade "FG" Lea Compound gives a medium butler relieving which requires no cleaning or drying before lacquering.

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